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Annual Energy Outlook 1990

With Projections to 2010

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Preface

The *Annual Energy Outlook 1990 (AEO)* is EIA's annual statement of projected energy trends for the long term. It presents trends in energy supply and demand based upon assumptions about world oil prices, economic growth, and other factors affecting energy markets. These trends have implications for national energy security, the environmental impact of energy use and production, and the role of technology in shaping the energy future.

The forecasts for this AEO have been extended to 2010, a 20-year perspective. Projecting for a longer time horizon than used for previous AEO's introduces additional uncertainty in the forecasts for later years. Consequently, it is important to consider the range of possible futures contained in the five cases contained here, rather than focus solely on the base case.

Five forecast cases are presented: a base case, low and high world oil price growth, and low and high macroeconomic growth. The base case is the central forecast. The four other cases are presented to reflect the uncertainty inherent in any forecast of the future. They are based on reasonable lower and upper bounds on two key factors that affect energy trends: world oil price and the rate of economic growth.

The base case is not a prophecy of the future. Too many future events will impinge dramatically upon energy markets that cannot be known in advance. Rather, the base case presents one picture of how energy futures might look under current energy policy, based on assumptions regarding economic growth, world oil prices, supply and demand for energy, and technologies for producing and using energy.

In keeping with EIA's longstanding policy, the forecasts in this report are intentionally policy neutral: they are based on current law, and no new energy laws or regulations are introduced for any purpose. Consequently, many issues that are likely to be important policy issues over the timeframe of these forecasts are not considered in these projections. These issues include the implications of changes in the Clean Air Act to address environmental concerns, long-term oil and gas leasing strategies, life extension for existing electricity generation facilities, and the role of nuclear energy in the future.

These forecasts are deliberately intended to establish a neutral base scenario that provides a "jumping-off point" for the analysis of future energy policies. New energy laws or regulations can be evaluated by incorporating them into the model in an appropriate fashion. The resulting forecasts may be compared with the policy neutral forecasts in this AEO to assess the policy's impact. The cases presented here thus provide a basis for evaluating the potential impact of future energy policies.

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Highlights

Table 1. Summary of Projections for 2010

	1988	Base Case	Low Oil Price Case	High Oil Price Case	Low Growth Case	High Growth Case
Primary Production (Quadrillion Btu)						
Petroleum	19.5	12.7	11.3	14.5	12.7	12.8
Natural Gas	17.5	20.4	20.0	20.6	19.7	20.9
Coal	20.7	35.2	35.2	34.7	31.4	38.0
Nuclear Power	5.7	6.5	6.5	6.5	6.5	6.5
Renewable Energy*	6.0	10.1	10.1	10.1	10.1	10.1
Total Primary Production	69.4	84.9	83.0	86.4	80.4	88.3
Net Imports (Quadrillion Btu)						
Petroleum (including SPR)	13.9	26.0	31.8	22.3	24.6	28.1
Natural Gas	1.2	2.9	2.9	2.9	2.7	3.2
Coal/Other (- indicates export)	-2.1	-4.9	-4.8	-4.9	-3.0	-6.5
Total Net Imports	13.1	24.1	29.9	20.3	24.2	24.8
Consumption (Quadrillion Btu)						
Petroleum Products	34.2	39.9	44.1	37.6	38.4	42.0
Natural Gas	18.6	22.8	22.5	23.0	21.8	23.7
Coal	18.8	28.9	29.1	28.4	27.0	30.1
Nuclear Power	5.7	6.5	6.5	6.5	6.5	6.5
Renewable Energy/Other*	6.1	10.3	10.3	10.3	10.3	10.3
Total Consumption	83.4	108.4	112.5	105.8	104.0	112.6
Prices (1989 dollars)						
World Oil Price * (dollars per barrel)	15.27	36.90	25.90	47.40	36.90	47.40
Domestic Natural Gas Wellhead (dollars per thousand cubic feet)	1.76	5.63	4.59	5.51	4.57	6.09
Domestic Coal Minemouth (dollars per short ton)	23.02	28.55	28.66	28.33	26.56	29.76
Average Electricity Price (cents per kilowatthour)	6.62	7.01	6.81	7.03	6.61	7.34
Economic Indicators						
Real Gross National Product (billion 1982 dollars)	4,024	6,799	6,921	6,721	6,297	7,331
(percent change, 1988-2010)	--	2.4%	2.5%	2.4%	2.1%	2.8%
GNP Implicit Price Deflator (index, 1982=1.000)	1.213	3.399	3.416	3.382	3.947	2.853
(percent change, 1988-2010)	--	4.8%	4.8%	4.8%	5.5%	4.0%
Real Disposable Personal Income (billion 1982 dollars)	2,793	4,358	4,408	4,324	4,110	4,617
(percent change, 1988-2010)	--	2.0%	2.1%	2.0%	1.8%	2.3%
Index of Manufacturing Production (index, 1982=1.000)	1.219	2.231	2.285	2.200	1.975	2.502
(percent change, 1988-2010)	--	2.8%	2.9%	2.8%	2.2%	3.3%
Energy Efficiency (thousand Btu per 1982 dollar of GNP)						
Oil and Gas Use	13.12	9.23	9.63	9.01	9.57	8.97
Electricity Use	2.19	2.15	2.15	2.13	2.21	2.11
Total Energy Use	20.72	15.95	16.25	15.74	16.52	15.36

*Forecasts of renewable energy production and consumption will vary depending on changes in conventional energy prices and growth in the economy. However, current projection methodologies do not distinguish these variations.

Note: For category definitions see Appendix A, footnotes to Tables A1 and A2.

Sources: See data sources in Appendix C.

Highlights

Total energy consumption in the United States continues to grow at about half the rate of GNP

Total domestic consumption of all forms of energy grows by between 25 and 35 percent over the next 20 years, depending on assumptions about future economic growth (see Table 1). The relative outlook for the major sources of energy, however, differ. Oil demand grows slowest (but still accounts for a significant absolute increase), and coal demand grows most rapidly (as a consequence of high electricity demand growth).

Oil prices resume long-term increase as OPEC share of market grows

Real oil prices are expected to remain relatively flat for a few more years. But rising demand, limits on future contributions from non-OPEC sources, and the concentration of world oil resources in OPEC nations will lead to more rapid price increases after the mid-1990's. Overall, prices are expected to rise between 2 and 5 percent annually over the forecast, reaching a level between \$26 and \$47 per barrel in 2010.

Falling U.S. oil output and rising demand lead to higher oil imports

U.S. oil production falls by as much as 4 million barrels per day over the forecast, and demand increases by a comparable amount. Even with more supplies from natural gas liquids and nonpetroleum sources, net petroleum imports grow by between 60 (with high oil prices) and 130 percent (with low oil prices) in total.

Transportation, industrial feedstocks lead rising petroleum demand

Motor gasoline demand grows by between 0.6 and 1.8 million barrels per day over the forecast, depending on world oil price assumptions, despite significant increases in fuel economy. High demand growth is also forecast for diesel, jet fuel, and LPGs.

Natural gas demand and prices pushed up by electric utilities

A recent turnaround in U.S. demand for natural gas has resulted in growing domestic production. Its use in this country could expand by between 20 and 30 percent by 2000, before leveling (depending on assumptions about economic growth). Net imports could double. The main source of growing demand is electric utilities.

Coal increases its share of total energy

Pushed by growing electricity demand and a preference by utilities for new coal-fired generating capacity, coal demand (in tons) grows at 2.1 percent annually in the base case through 2010—more than any other fuel. (Coal demand growth ranges between 1.8 percent and 2.3 percent annually, depending on economic growth assumptions.)

Electricity demand follows GNP growth, as coal and gas use rise sharply

Electricity sales rise at approximately the same rate as GNP, and new fossil fuel plants meet most of the Nation's growing demand. New capacity for gas-fired combined-cycle plants is especially significant, but overall growth for coal is greatest. No newly ordered nuclear units are assumed.

Renewable energy use grows

Renewable energy use grows significantly, accounting for about 9 percent of total energy requirements by 2010. Use is concentrated in electric utilities (hydropower), industry (heat from wood waste), and homes (wood).

Assumptions

- **World Oil Prices**
- **Economic Growth**

World Oil Prices

Relatively low oil prices may be anticipated for a few more years, as the Organization of Petroleum Exporting Countries (OPEC) works to control the combined output of member countries with dissimilar interests (Figure 1). Growing non-OPEC oil production is also contributing to current instability, although that growth is now slowing. By 2000, more fundamental forces of supply and demand should raise prices (absent any dramatic technological changes), as oil consumption rises toward world production capacity. Oil prices are forecast to rise from \$18 per barrel in 1989 to between \$26 and \$47 per barrel by 2010 (1989 dollars).

OPEC's Near-Term Influence Is Tied to Management of Excess Capacity

In the current market, the ability (or inability) of a relatively small set of producers to limit their production to be much less than their production capacity is the key determinant of prices. OPEC has

a difficult time controlling the output of its member countries, because those members are characterized by widely divergent social and economic problems, and self interests. For example, some countries such as Saudi Arabia have extensive oil reserves which will last well into the next century. Given this fact, Saudi Arabia desires to maintain production and pricing in a manner that will guarantee a market for its oil over the long run. Other countries, such as Algeria, Libya, and Indonesia, have reserves that will not last nearly as long as those of Saudi Arabia and therefore are interested in receiving higher prices in the near term.

The consequences to Saudi Arabia, and the other OPEC members with high production, of past prices in the \$40-per-barrel range are well documented, and such prices are the reason for the current problem (from OPEC's perspective). Prices at those levels caused decreases in demand and increases in non-OPEC production sufficient to drive OPEC's market share from about 70 percent to about 35 percent in less than 10 years (Figure 2). Technology has played an important role in getting to today's market situation. Technology lies behind much of the decline in oil use per dollar of economic output and behind non-OPEC production increases.

On the other hand, current relatively low prices should bring supply and demand more in balance in the future. Low prices have already caused moderate increases in demand, particularly in the United States and in the lesser developed countries. On the supply side non-OPEC production has continued to increase. However, the rate of increase is slowing, and most analysts expect non-OPEC production to begin declining sometime in the next 10 years.

Oil supply and demand have not reacted strongly to the low prices of the last couple of years. One reason for this is that governments in consuming and producing countries have reacted with policy changes to counteract some of the impacts of the fall in prices. For example, in Europe, consumers have seen little benefit of lower prices as taxes have increased in the face of falling prices. The non-OPEC producing countries lowered taxes on producers in a largely successful attempt to maintain the profitability of projects in light of lower prices.

The Longer Term Outlook for Oil Prices Reflects Dominance of OPEC Resource Base

Once the current excess in world oil production capacity is reduced, market and technological factors will more directly influence the intensity of energy and oil use (demand) and the ultimate market based cost of production (supply). Together, these factors

Oil Prices Rise Under All Scenarios

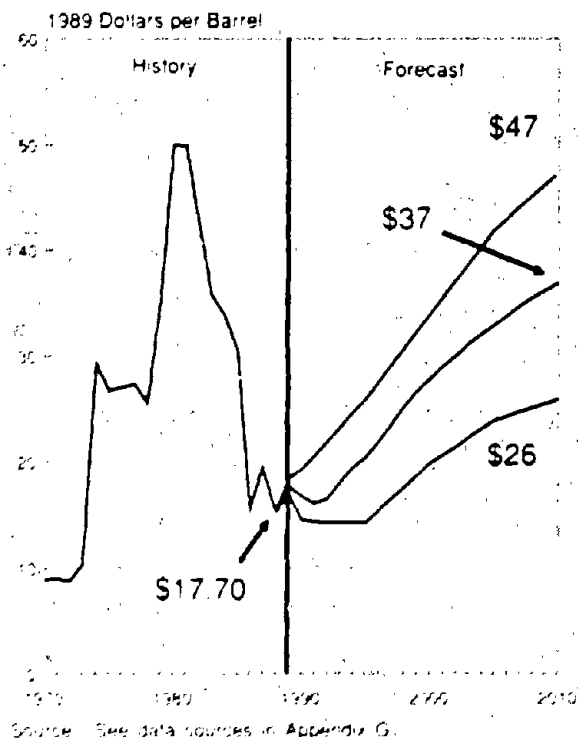
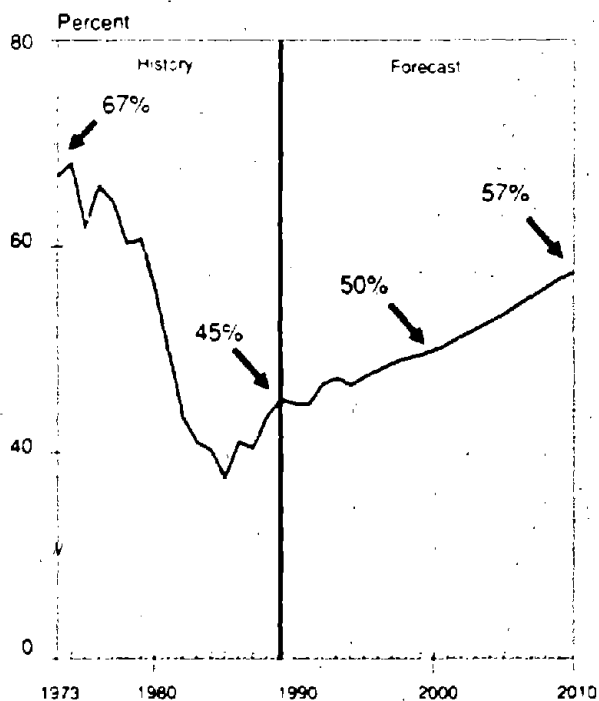


Figure 1. U.S. Refiners' Acquisition Cost of Imported Crude Oil, 1970-2010

OPEC Resumes Dominant Role in World Market



Source: See data sources in Appendix G.

Figure 2. OPEC Oil Production as Percent of Market Economy Demand, Base Case, 1973-2010

determine the price of oil necessary to equilibrate the market.

During the early 1990's, oil production from various non-OPEC sources should continue to increase. However, by the late 1990's, as production from all non-OPEC sources declines, the market share of OPEC will steadily increase. In the base case forecast, OPEC's share of world oil production reaches almost 50 percent by 2000. Demand for OPEC oil approaches OPEC capacity in the late 1990's, and oil prices rise. The rate of increase in real world oil prices should be somewhat slower after 2000 than before 2000, as capacity increases (both inside and outside OPEC) begin to match demand requirements.

In the longer term, as oil demand rises toward production capacity, fundamental market forces will more directly influence world oil prices. These economic forces are those which determine the supply and demand for oil and therefore are dependent on such factors as economic growth, technological change

as applied to the production and consumption of energy, and the size of the resource base.

Improvements in the technology of locating and developing oil resources have long played an important role in bringing additional oil supplies to market. Oil prices will also be influenced by the cost of development of natural gas resources. Should natural gas turn out to be relatively inexpensive to develop and distribute, this additional pressure will continue to keep oil prices from rising too rapidly. While at present natural gas principally competes as a boiler fuel with oil, this market is large enough (especially in Europe) to have a major influence on oil prices.

Technology on the demand side is also an important factor in determining oil prices. Based on trends in declining energy use per dollar of gross domestic product (GDP) in major countries over the last 2 decades, energy use is clearly becoming more efficient even taking changes in the product mix demanded into account. Product-mix effects have been reflected in shifting consumer preferences towards products that require less energy to produce. This trend does not represent "conservation" in the technological sense of producing the same output with less energy.

Changing Sources of World Supply and Demand

About two-thirds of the world's proved oil reserves are in the Middle East (virtually all in the Persian Gulf). Five countries—China, Mexico, Norway, the United States, and the Soviet Union—hold the vast majority of non-OPEC oil reserves. However, total non-OPEC production is expected to peak by the mid-1990's. The development of proved reserves discovered in the early 1980's should allow non-OPEC countries such as Syria, Colombia, India, Brazil, the United Kingdom, Norway, North Yemen, and South Yemen to increase oil production, but will only offset the decline in oil production from other non-OPEC countries. The net result will be increasingly concentrated production capacity within a small group of producers, particularly the Persian Gulf "core" producers of Saudi Arabia, Iran, Iraq, Kuwait, and the United Arab Emirates.

Accounting for about four out of every five barrels of oil consumed in the world, the Market Economies (excluding the Centrally Planned Economies of Eastern Europe, the Soviet Union, and China) exert the major influence on oil consumption trends in the world as a whole (Table 2). And, oil consumption by these

countries is expected to grow. At the same time, oil consumption in the Centrally Planned Economies is projected to decline steadily through 2010, with a shift to natural gas use in the Soviet Union. Much of the growth in oil consumption is projected to occur in the United States. Mexico, Brazil, and India are and should continue to be the largest consumers of oil among the developing countries. A major uncertainty concerning growth in oil demand in Mexico, Brazil, and other developing countries arises from the problem of Third World debt.

Economic Growth

The economy is assumed to grow at an average annual rate between 2.1 and 2.8 percent over the period 1989 through 2010 (Figure 3). Growth is slightly stronger in the earlier years of the forecast and levels off after 2000. This shift represents a continuing slowdown in the long-term rate of growth of the economy, which is fundamentally determined by the rate of expansion of the resource base of the economy—labor, capital, energy—and changes in the productivity of these factors.

A decline in the rate of growth in the labor force is assumed to continue due to the slowing of population growth and a leveling off in the rate of entry of women into the workforce. The decline in labor force growth rates is a major contributor to the expected slowdown in the rate of growth in the potential output of the economy. Throughout the forecast period, growth in the capital stock is expected to improve relative to the rather weak growth of the 1980's.

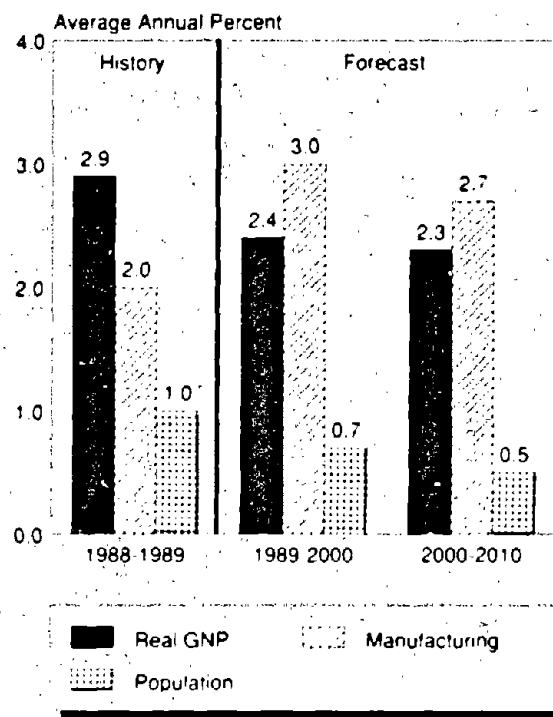
Inflation, measured by the change in the implicit GNP price deflator, averages 4.0 to 5.5 percent over the forecast period, with prices increasing at a slightly higher rate during the later 10 years.

Interest rates decline early in the forecast period, and by 1995 attain relative stability over the remaining part of the forecast. Interest-rate sensitive sectors of the economy, such as housing and new cars sales, show flat growth over the period between 1989 and 2010.

The rate of overall industrial growth and the growth in each component sector are linked to the size and configuration of the aggregate economy. Personal expenditures on consumer items are expected to decline as a share of GNP. A larger share of the GNP is devoted to the production of goods going into

investment and export categories of final demand. As a result, manufacturing output is expected to grow at a rate of between 2.2 and 3.3 percent through 2010.

However, the composition of industrial growth is uneven. Production of machinery (Standard Industrial Classifications 34-38) is expected to rise the fastest (2.9 to 4.4 percent per year through 2010), fundamentally driven by investment and export related demand. The largest component of growth within this sector is office equipment, including computers. Production within the primary metals sector (SIC 33) is expected to show a moderate rebound (0.8 to 1.9 percent) from the slow to negative growth of the 1980's. The recovery is primarily in the production of higher value-added products as opposed to raw, unprocessed basic commodities. Production in the chemical and plastic sectors (SIC 28 and SIC 30) is expected to show steady growth over the forecast period. Much of the growth in these sectors is also export driven.



Source: See data sources in Appendix G

Figure 3. Average Annual Growth Rates for Selected Economic Indicators, Base Case

Table 2. Summary of Assumptions and Projections for the Market Economies

	1988	Projections	
		2000	2010
Economic Growth Rates (percent per year) ^a	4.0	2.2 - 3.0	2.2 - 3.0
OPEC Oil Production Capacity (million barrels per day) ^b	28.2	34 - 36	41 - 45
Oil Prices (1989 dollars per barrel) ^c	\$15.18	\$20 - \$34	\$26 - \$47
Oil Production (million barrels per day) ^d			
Non-OPEC	27.1	25.7 - 27.4	23.5 - 25.6
OPEC	22.0	24.4 - 32.3	28.4 - 40.1
Energy Consumption			
Oil (million barrels per day)	50.7	53.1 - 60.7	53.5 - 65.0
Gas (trillion cubic feet)	40.7	50.1 - 70.7	53.2 - 82.0
Coal (million short tons)	2,299	2,604 - 3,565	2,941 - 4,242
Nuclear (terawatthours)	1,510	1,796 - 1,912	2,096 - 2,575
Other (quadrillion Btu) ^e	20.5	24.5 - 33.6	26.5 - 37.4
Total Primary Energy (quadrillion Btu)	227	268 - 282	291 - 317

^aThe 2000 and 2010 projections represent ranges of average annual rates of growth from 1988 to 2000 and 1988 to 2010, respectively.

^bProduction capacity is defined as maximum sustainable production, adjusted to reflect current operable capacity in some countries.

^cOil prices are defined as the U.S. refiner acquisition cost of imported oil.

^dIncludes crude oil, lease condensate, natural gas liquids, other liquids, and refinery gain.

^eIncludes hydroelectric, geothermal, and other energy sources.

OPEC = Organization of Petroleum Exporting Countries.

Note: Market Economies include all countries except those with centrally planned economies: Eastern Europe, the Soviet Union, China, Cuba, Kampuchea, North Korea, Laos, Mongolia, Vietnam, and Yugoslavia.

Sources: See data sources in Appendix G.

Energy Sources and Uses

- **Energy Sources**
- **Energy Uses**
- **Energy Efficiency**
- **Energy Security**
- **Energy and the Environment**

Energy Sources

For most U.S. citizens and businesses the future energy picture will not look very different from today, and many of the same energy concerns will remain. Oil supplies will be more concentrated in the Middle East, the United States will be more dependent on imports, energy costs will be higher in real terms, and environmental problems may be exacerbated by trends in fuel choice. At the same time, many changes in the way this country produces, prices, and uses energy may be expected that will contribute to sustained growth in an economy that can select from more forms of energy and that is technically more efficient in the use of energy.

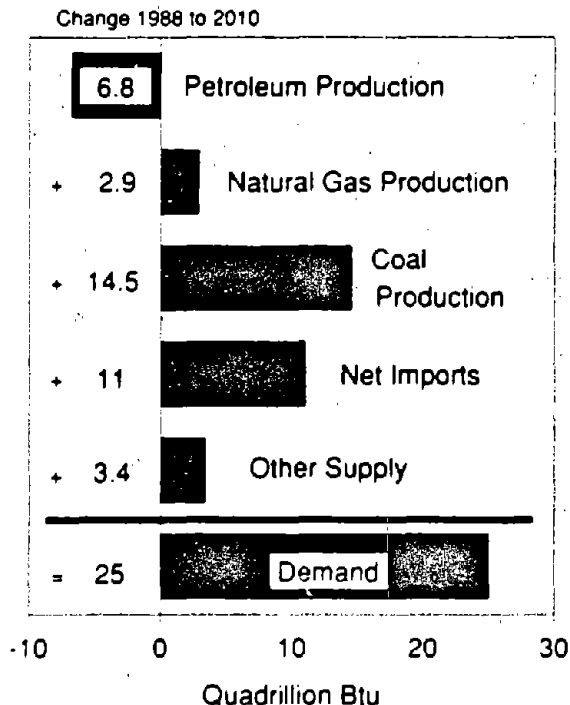
Petroleum is and will remain the main source of energy for the United States into the 21st century. But as domestic production of crude oil falls, growing volumes of oil will need to be imported (Figure 4). With only minor offsets from increased alcohol fuels and natural gas liquids supply, net petroleum imports

grow 3.3 million barrels per day in total over the forecast, assuming high world oil prices, and 8.3 million barrels per day assuming low prices. As a basic source of energy to meet the Nation's growing requirements, only increased domestic coal production supplies more than imports. Increased coal and natural gas output are both needed to fuel the economy's growing demand for electricity (Figure 5).

Energy Uses

Growth in the different forms of energy consumed by end users (i.e., excluding electric utilities) is fairly evenly balanced between petroleum products and electricity. Because of the sheer magnitude of petroleum use in this country, however, the percentage growth for petroleum is lower than that for electricity. Major improvements in the efficiency with which this economy uses petroleum products, regional shifts in population to the West and South, and low growth in the energy intensive, heavy

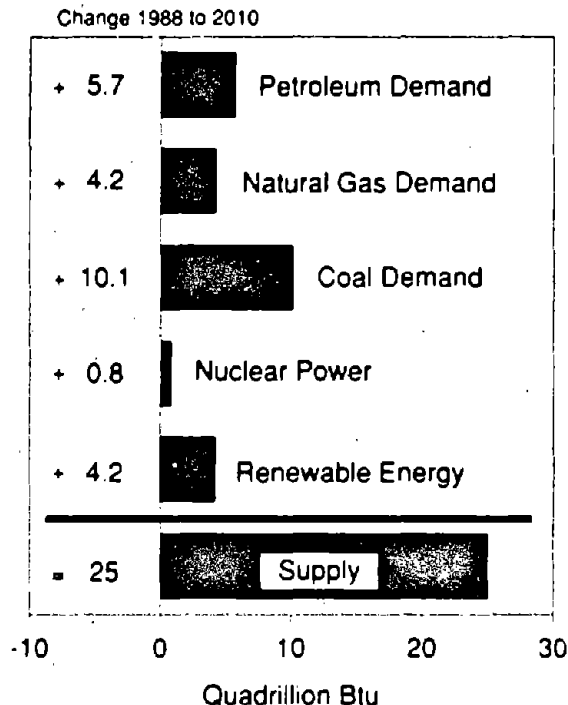
Coal Production and Energy Imports Rise to Meet Demand



Source: See data sources in Appendix G.

Figure 4. Changes In Sources of Energy, Base Case, 1988-2010

Coal Demand for Electricity Generation Dominates Outlook for Fuel Needs



Source: See data sources in Appendix G.

Figure 5. Changes In Energy Demands, Base Case, 1988-2010

industrial activities all combine to restrain growth in oil use (0.5 to 1.2 percent) to less than one-half that for the economy at large (GNP growth ranges between 2.1 and 2.8 percent).

The consequences of the Nation's growing demand for electricity in homes and businesses are increased by the need to divert even more energy to the generation and transmission of that electricity. An outlook for continued electricity sales growth of between 2.1 to 2.6 percent annually, based on extreme economic growth assumptions, means that more primary energy in the form of coal, natural gas, and renewable energy will be demanded by utilities. Oil-fired, hydroelectric, and nuclear generating capacity are all limited in the future (by economics, technology, or current regulations). Electricity growth is especially high in the western and southern States, reflecting the higher population growth in those parts of the country. Additional changes for the electricity picture are expected as nonutilities and imports supply a growing share of total sales. The preference for electricity reflects in large part the outlook for relatively low growth in electricity prices.

Of the major end-use energy consuming sectors (residential, commercial, industrial, and transportation), demand for energy in all forms is highest in the industrial sector, both now and in the future (Figure 6). Natural gas remains the most important industrial fuel, although its growth lags that for electricity and feedstocks. Almost 80 percent of total electricity used by industry in this country in 1989 was for heat and power in manufacturing activities. The fastest growing industries are expected to be metal durables (including electronics) and chemicals.

Transportation uses of energy lag industrial uses only slightly, but the overwhelming dependence of transportation activities on petroleum products (over 95 percent) has made this sector the focus of energy policy concerns. In particular, motor gasoline accounted for 63 percent of total transportation demand and 16 percent of the Nation's total energy requirements in 1989. This picture changes only slightly in the next 20 years, as gasoline's share of total transportation demand drops to 58 percent and as an additional 5 percent of that gasoline volume comes from ethanol and methanol. This AEO includes no significant role for alternative motor fuels in the next 20 years.

Energy Efficiency

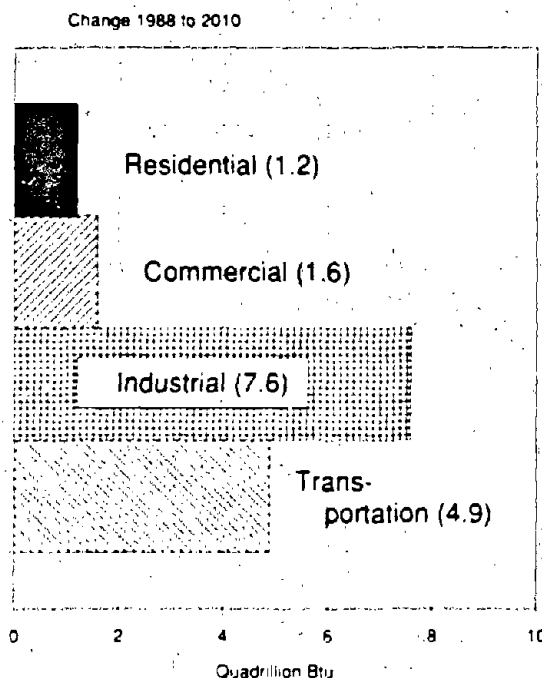
Total energy consumption growth is constrained by efficiency improvements, and shifts in economic activity from energy intensive sectors to less energy

intensive sectors and to less energy intensive activities within those sectors.

The energy intensity of the United States economy (measured as the amount of energy consumed per unit of economic output) is a useful indicator of energy efficiency. As demonstrated in Figure 7, the decline (rise) in total energy intensity (efficiency) is helped by the declining use of oil and gas by the economy, but hindered by virtually constant intensity of electricity use. This trend reflects a continuing consumer preference for electrical appliances especially heating and cooling systems.

Figure 8 presents several more direct indicators of technical energy efficiency in specific sectors. Average improvements in automobile mileage outpace efficiency gains in home energy use by a factor of 2, in part because of greater replacement rates for cars. Industry gains reflect shifts in economic activity as well as technical changes.

Transportation, Industrial Sectors Lead Demand Increase



Source: See data sources in Appendix G.

Figure 6. Changes in Energy Demand by Major End-Use Sector, Base Case, 1988-2010

Shift to Electricity Slows Decline in Total Energy Intensity

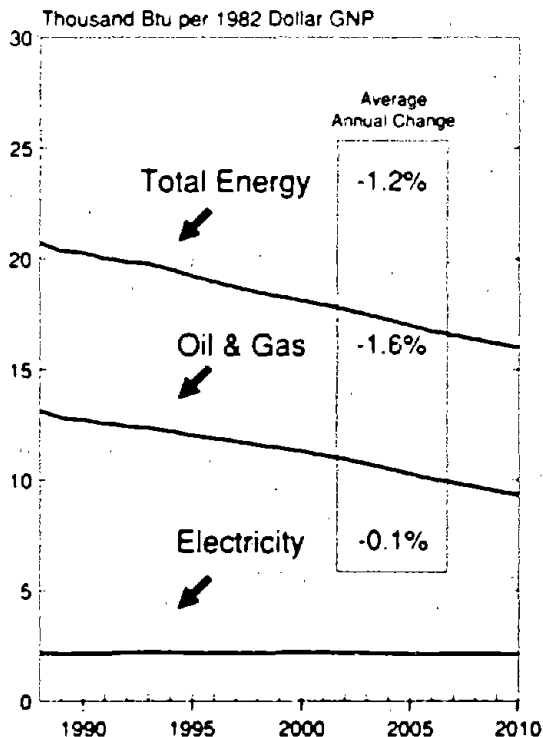


Figure 7. U.S. Energy Intensity, Base Case, 1988-2010

Energy Security

In the last 3 years, U.S. petroleum imports have increased so rapidly that 1989 net imports are almost 3 million barrels per day, or about 70 percent, higher than they were in 1985. This dramatic increase has led to many questions concerning renewed U.S. vulnerability to oil disruptions. There are two major factors that serve to limit the increase in U.S. vulnerability.

The first relates to the relationship between the United States and the rest of the world oil market. While U.S. imports have increased, the Market Economies' reliance on OPEC has not increased as much. Although the OPEC share of market economy

High Technical-Efficiency Gains Expected For Automobiles

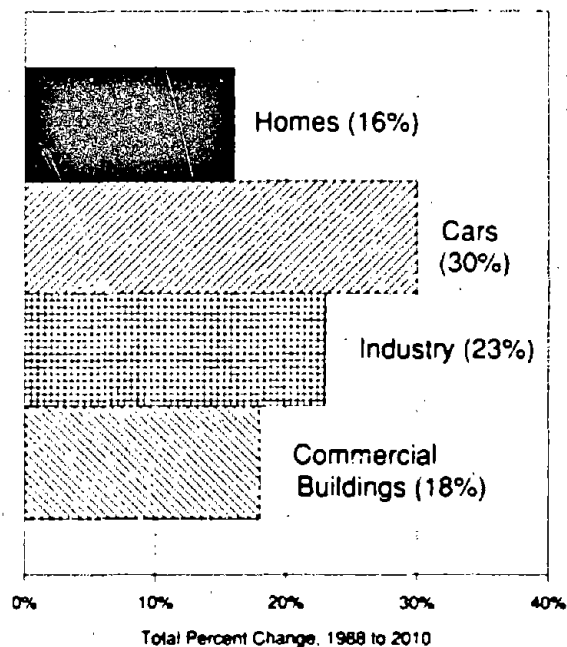


Figure 8. Changes in Average Efficiency for Selected Energy Uses, Base Case, 1988-2010

demand is projected to grow significantly throughout the forecast period, it still remains below the high 67 percent level attained in 1973.

The second major factor that serves to mitigate the impact of a disruption (or even reduce the probability of a disruption even occurring) is the existence of strategic petroleum stocks in the United States and in other consuming countries. U.S. strategic stocks now exceed 580 million barrels and can be drawn down at a rate exceeding 3 million barrels per day for 6 months (or about one-half of our current import levels). The U.S. strategic reserve is planned to be filled to 750 million barrels by 2000. In addition, it is estimated that the combined stocks of Japan and West Germany can be drawn at a rate of 2 million barrels per day for several months.

Energy and the Environment

The U.S. economy is forecast to become increasingly dependent on fossil fuels, especially coal. Even as total consumption of energy grows by almost 30 percent in the next 20 years, the share of coal grows from 23 percent in 1989 to between 26 and 27 percent in 2010 (based on extreme economic growth assumptions). Coal demand is driven predominantly by the demand for electricity. The share accounted for by petroleum products declines by a comparable amount, but this masks a total increase of almost 20 percent in oil use over the forecast. Thus, it may be expected that today's concerns with acid rain, local automobile-related pollution, and global warming will not go away soon. Forecasts in this AEO do not attempt to quantify these concerns or address new policy initiatives in the environmental area.

Perhaps improving the environmental outlook, natural gas use grows significantly, as gas maintains its share of the total energy market. As with coal, however,

the growth in gas demand is predominantly for the generation of electricity. (Residential and commercial use of natural gas remains almost flat.) Gas is a relatively clean fuel with respect to carbon and sulfur emissions, but it is not without problems. Methane, the main constituent of natural gas, is also a greenhouse gas and is believed to be much more efficient in trapping heat than is carbon dioxide. Increased release of methane to the atmosphere associated with natural gas production and transportation activities may also be an environmental concern.

This AEO includes some growth in the demand for renewable energy forms. That consumption is now principally at electric utilities (hydropower), industry (waste heat in pulp and paper), and homes (wood). Growth at utilities is constrained by available hydropower, and new growth is expected to be concentrated in industry and residences. No major inroads are expected in the transportation sector or from solar and wind technologies.

U.S. Petroleum Markets

- **Crude Oil and Gas Liquids**
- **Petroleum Imports**
- **Refined Petroleum Products**

Crude Oil and Natural Gas Liquids

Domestic Oil Output Continues Its Decline

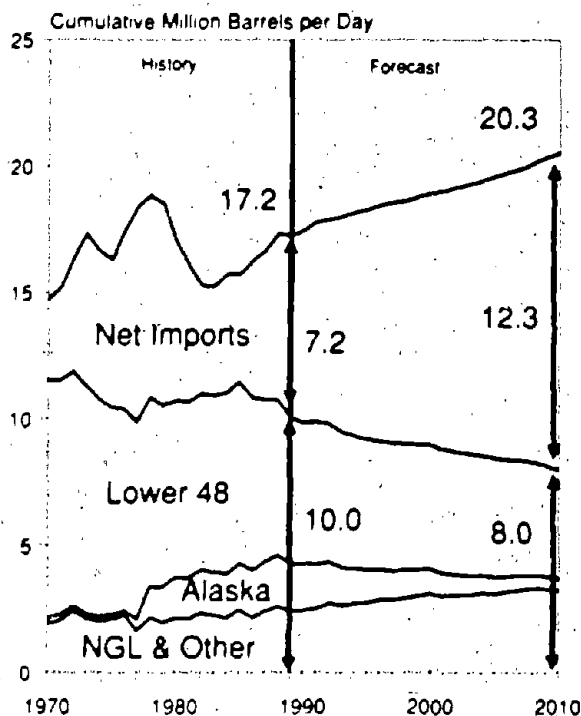
The decline in domestic crude oil production is expected to continue throughout the forecast horizon, although its rate is expected to slow considerably, compared to recent history (Figure 9). From 1985 through 1988, production declined at 3.2 percent per year, as many marginal producing wells ceased to be profitable with the fall in oil prices in 1986. Even though domestic oil prices will rise over the next 20 years in both the low and high price scenarios, the production decline continues, ranging between 1.7 percent (high price scenario) and 3.1 percent (low price scenario) per year. From 7.7 million barrels per day in 1989, production drops to between 4.1 and 5.6 million barrels per day in 2010.

The most rapid change will be in Alaskan production, which currently accounts for nearly 25 percent of total domestic crude oil production. Alaskan North Slope oil flow has now passed its peak levels. The Prudhoe

Bay field, the largest in the area, entered its decline phase in 1989. The remaining primary fields are expected to follow in the early 1990's. Recent United States Geological Survey (USGS) studies estimate that 34 percent of the U.S. undiscovered recoverable resource base lies in Alaska, but the prospect of significant new development of Alaskan reservoirs through the forecast horizon is unlikely in currently available acreage. Due to the current legislative restrictions on exploration and development, it is assumed that the Coastal Plain of the Arctic National Wildlife Refuge will not be developed before the end of the forecast horizon.

Based on recently published USGS estimates of mean undiscovered recoverable resources (*Estimates of Undiscovered Conventional Oil & Gas Resources in the United States*, USGS and Minerals Management Service, 1989), the Outer Continental Shelf offers the most potential, with 38 percent of the Nation's undiscovered recoverable crude oil resource base. Production from projected discoveries in this area will likely mitigate the Lower-48 production decline. However, even with increasing prices, onshore reserve additions are not expected to keep pace with production.

Growing Demand, Falling Production Point to Higher Imports



Source: See data sources in Appendix G.

Figure 9. Petroleum Supply and Consumption, Base Case, 1970-2010

Environmental concerns have always played a major role in decisions regarding exploration and drilling for crude oil in new frontiers. The oil spill in Alaska's Prince William Sound in early 1989 acted to intensify environmental concerns. Congress is now pursuing an increasingly conservative approach to tapping into oil resources in Alaska and the Outer Continental Shelf. In October, President Bush signed a bill banning oil and gas drilling on 84 million acres off the coasts of Alaska, California, the East Coast, and the eastern Gulf of Mexico. In addition, an existing 1-year moratorium on leasing in these areas is expected to be extended. There is consideration of further restrictions on offshore drilling and possible buybacks of existing leases, which has already delayed the start of some planned projects.

Natural Gas Liquids, Nonhydrocarbon Sources Help Support Petroleum Supplies

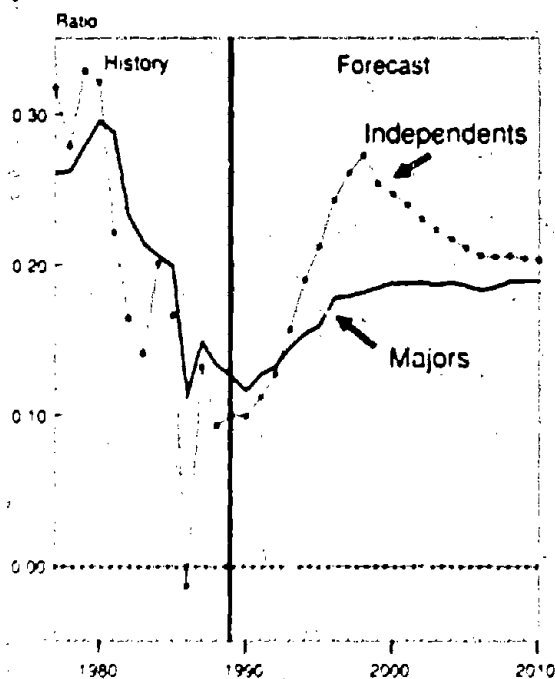
The production of natural gas liquids (propane, butane, and other liquid fuels extracted in the process of producing pipeline-quality natural gas) is expected to grow at only modest rates, depending upon the outlook for natural gas, and will range from about 20 to 26 percent of total domestic production. Further variations in gas liquids demand may be anticipated as a consequence of changing petrochemical industry demand for feedstocks and of changing environmental policy (as less butane and isobutane is used by refiners as gasoline blending components).

Growing contributions from other sources (including ethanol, methanol, petroleum from the liquefaction of coal, and other hydrocarbons) are also expected to add to total petroleum production. The production of ethers from ethanol, methanol, and petroleum feedstocks grows to meet rising demands for these fuels in response to clean air legislation.

Short-Term Weakness Gives Way to Long-Term Improvement in Financial Picture for Oil and Gas Producers

Buoyed by rapidly increasing oil and gas prices during the middle and late 1990's, both independent and major domestic oil and gas producers should see improvement in their income statements in the coming years (Figure 10). Independent producers, who historically have been more concentrated in gas production than the majors, should see a more dramatic improvement due to more rapid natural gas price increases.

Rising Natural Gas Prices and Production Favor Independent Producers



Source: See data sources in Appendix G

Figure 10. Ratio of Cash Flow to Fixed Assets for U.S. Oil and Gas Producers, Base Case, 1977-2010

This improvement, however, will be slow in coming and will come despite slow or declining growth in production. Between 1989 and 2010, domestic oil production from the Lower 48 States is expected to fall an average of 1.6 percent per year in the base case, while domestic gas production will exhibit a very moderate 0.7 percent growth. The outlook for the short-range future remains weak as production declines will outpace real price increases over the next 3 years.

Historically, rapid growth in drilling investment has followed large increases in energy prices. However, the volatility of the world oil price throughout the 1980's has had a chilling effect on the responsiveness of investment to price changes, particularly for the independent producers (who rely more heavily than the majors on external financing).

Strong revenue growth, coupled with more moderate increases in operating costs and investment, will contribute to improved cash flow for the independents. ("Majors" are defined as the 22 large energy companies that report to EIA's Financial Reporting System. "Independents" are all other oil and gas companies. Financial results for independents are derived from published information on publicly traded companies. Results shown here represent information on domestic oil and gas extraction activities.)

Petroleum Imports

Foreign Sources Will Supply Nearly Two-Thirds of Domestic Petroleum Requirements by 2010

Given the projection for growing petroleum demand and assumed limitations on the domestic resource base, a conclusion of higher petroleum imports in the future is difficult to avoid. In this year's outlook, net petroleum imports of crude oil and refined product (i.e., imports minus exports) are forecast to increase from 7.2 million barrels per day in 1989 to between 10.4 and 14.9 million barrels per day in 2010 depending upon world oil prices and the domestic economic outlook. (Higher import projections are based on low oil price assumptions; low projections are based on high oil prices.) In comparison, the highest historical level of annual net imports was reached in 1977, at 8.6 million barrels per day. The forecast for 2010 reflects an import dependence (net imports divided by total petroleum demand) of 54 to 67 percent, up from 42 percent in 1989. Historically, import dependence reached a peak in 1977, at 46.5 percent.

Increased petroleum imports are forecast to come mainly in the form of crude oil. This assumes there are no major changes in the relative economics of refining petroleum products in the United States and in the other major refining centers of the world. The outlook for stable product trade patterns could be altered as a consequence either of major changes in the relative mix of products demanded in the United States or abroad or of additional refining costs imposed by the need to accommodate environmental concerns.

Refined Petroleum Products

Demand growth in the United States is dominated by transportation fuels, including motor gasoline, jet fuel, and diesel and also by growth in industrial feedstocks with relatively little growth for the remaining third of the oil market. The high petroleum demand forecasts presented here are based on low oil price assumptions; the low, on high prices.

Transportation Needs Continue to Dominate U.S. Oil Use

Transportation requirements are expected to continue to dominate petroleum markets, accounting for an estimated 62 percent of total petroleum consumption in 1989 and from 63 to 65 percent by 2010.

Population growth and economic expansion are the main forces behind the growth in gasoline consumption, raising vehicle-miles traveled by about 1.8 percent per year. Ongoing increases in fleet average fuel economy are expected, which will limit the growth of gasoline consumption (Figure 11). Gasoline demand is projected to rise at an average rate of 0.3 to 1.0 percent per year, substantially less than that of the past several years, but still leading to an increase in gasoline demand of 0.6 to 1.8 million barrels per day by 2010.

Environment, Efficiency Concerns Influence Outlook for Motor Gasoline

Accommodating the absolute magnitude of the increase in gasoline demand, along with likely shifts to cleaner gasoline, will entail a major investment in downstream processing by refiners that will pose a major challenge to the industry over the next 20 years.

Due to increasing environmental concerns in the United States over the past few years, refiners marketing gasoline here have had to respond to anti-pollution measures, including lead phase-down and vapor pressure reduction. A few States and local

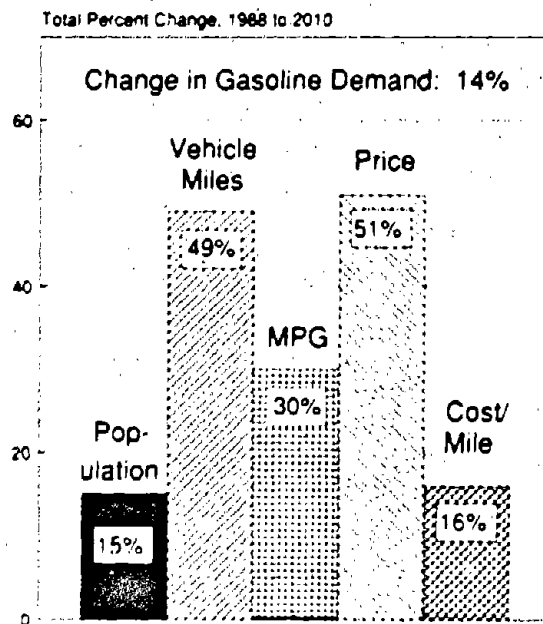
areas also impose requirements on the use of oxygenates—alcohols such as methanol or ethanol, and alcohol-based ethers.

As efforts to maintain high octane levels, reduce carbon monoxide and other emissions, and lower the aromatic content of gasoline intensify, the use of oxygenates in producing gasoline is expected to grow. Although the United States has led the way, several other countries, especially in Europe, have also instituted pollution control measures.

Alternative automobile fuels, such as ethanol or mixtures of 85 percent methanol and 15 percent gasoline, will require engine redesign. In the period from 1989 to 2010, only very minor penetration of these fuels is expected to occur.

Several alcohol and ether alternatives for gasoline blending are being studied to understand their longer term engineering and pollution properties. These include methyl tertiary butyl ether (MTBE, made from natural gas-based methanol and petroleum), ethanol (produced from biomass), and ethyl tertiary butyl

Gasoline Demand Fueled by Population Growth, Restrained by Efficiency Gains



Source: See data sources in Appendix G.

Figure 11. Changes in Determinants of Gasoline Demand, Base Case, 1988-2010

ether (ETBE, made from ethanol and petroleum). The growth in use of these oxygenates will depend on the costs of respective feedstocks and the extent of government subsidies.

Provisions of the President's proposed Clean Air Act would require tighter emission controls on refinery operations that could increase domestic refiner costs substantially, especially for older refineries. Unless foreign regulations follow suit, domestic refiners could find themselves at a competitive disadvantage, increasing the proportion of product imports versus crude oil imports. These changes are not reflected in this AEO.

Jet Fuel Demand Continues High Growth Rates

Though jet fuel consumption rose rapidly over the last 2 decades due to the rapid expansion of air travel, domestic growth after 1990 is estimated to be

from 1.1 to 1.8 percent per year—or, in the base case, only half that of the previous 20 years. Several factors account for the moderation in demand growth, but the principal changes are the moderation in passenger and freight demand and the progressive improvement in aircraft efficiency. Travel demand is projected to increase by 3.4 to 3.9 percent per year, compared to 6 percent per year during the 1980's. This change can be traced to the average economic trend assumed, to the anticipated effects of congestion on travel growth, and, most recently, to higher ticket prices.

Most of the improvements in aircraft efficiency have come from the operational side the spread of regional hubs to route air traffic and the use of aircraft better suited to trip length. In the forecast, aircraft efficiency improves as new aircraft are placed into service. Relatively larger planes are favored by the airlines. Jet fuel consumption for defense purposes is assumed to remain at current levels.

Outlook for Other Major Energy Sources

- **Natural Gas**
- **Coal**
- **Electricity**
- **Nuclear Energy**
- **Renewable Energy**

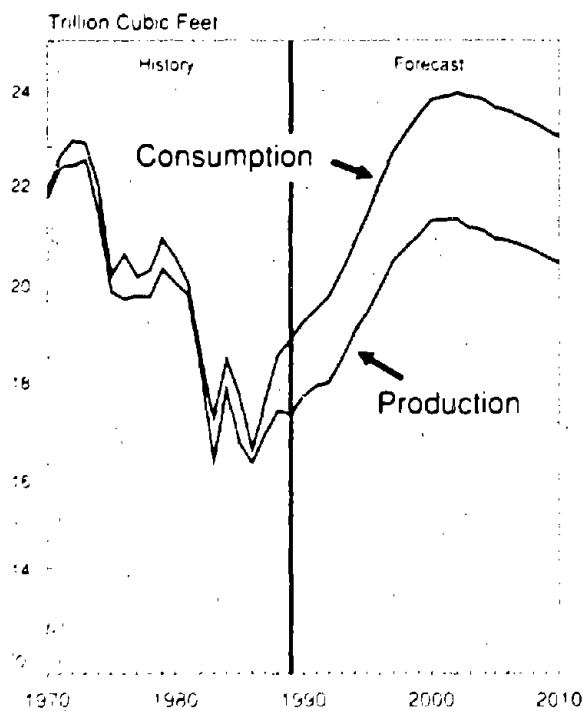
Natural Gas

Electric Utilities Lead Rise in Gas Use

The electric utility sector is expected to be the fastest growing market for natural gas. Accounting for only 15 percent of total gas use in 1989, the utility sector is projected to increase its share to about 26 percent in 2010 for the base, low and high economic growth scenarios. The strong growth in demand can be attributed to increased gas use in existing steam plants and in future gas-fired combined-cycle and turbine plants. Combined-cycle units are likely to meet 16 to 22 percent of the utility sector's total need for new generating capability in 2010 for the high and low growth cases respectively, with coal providing more capacity in the high growth case. After 2000, rising gas prices relative to coal prices restrain further utility gas demand increases in all cases (Figure 12).

The industrial sector is and will remain the largest gas consumer in this country. However, the industrial share will shrink relative to its 1989 level, accounting for 31 to 34 percent in 2010, depending on

Steady Growth in Gas Markets



Source: See data sources in Appendix G.

Figure 12. Natural Gas Consumption and Production, Base Case, 1970-2010

the level of economic growth. This pattern reflects the net outcome of two divergent trends. Gas use for industrial boilers will decline, but this trend will be offset by rising gas use for cogeneration of heat and electricity, both for own use and for sale back to electric utilities.

In the residential and commercial buildings sector, natural gas consumption in 2010 is forecast to be from 7.1 to 7.3 trillion cubic feet, about the same as it was in 1989. Its primary use is for space and water heating. Although natural gas currently accounts for about 50 percent of energy use by residential users (more than heating oil and electricity combined), the preference for electric-powered heating systems in new homes, the greater efficiency of new gas heaters, and ongoing upgrades of old gas systems all combine to restrain total demand growth for this fuel.

Domestic Supply of Gas Grows, But at a High Cost

Domestic production provides the largest source of natural gas supply and will increase through the year 2000 before steadily higher prices reduce consumption, and therefore production. Over the forecast period wellhead prices rise from \$1.76 in 1988 to between \$4.57 and \$6.09 in 2010, depending upon consumption and economic growth scenarios, with higher consumption producing higher prices. Increased production occurs as the level of developmental intensity in the Lower 48 States grows over time, giving higher rates of extraction. Natural gas from the North Slope fields of Alaska is projected to begin flowing to the Lower 48 States around 2005, with the construction of the Alaskan Natural Gas Transportation System (ANGTS). This system is projected to deliver over 800 billion cubic feet per year to the Lower 48 States.

Imports of Natural Gas Nearly Double

Increasing shares of natural gas supply to the United States are expected to come primarily from Canada. Current capacity of the Canadian pipeline system may limit the amount of gas flowing across the border for the next few years, especially in certain regions. Existing pipeline capacity across the U.S. border can accommodate flows up to roughly 1.8 trillion cubic feet per year, although seasonal demand swings and logistical problems can be expected to limit average capacity to about 1.3 trillion cubic feet. Capacity associated with current expansion plans would raise the aggregate capacity from Canada by an additional 1.2 trillion cubic feet per year overall. However, a more likely estimate of the average capacity expansion would be 700 to 800 billion cubic feet per year allowing for seasonal fluctuations. Transmission capacity is not expected to be a constraining factor in

the long run. Imports from Canada beyond the next few years are assumed to be affected more by resource availability.

The Yukon Pacific Project to export Alaskan natural gas to Pacific rim countries was recently approved by the Department of Energy. However, the authorization by DOE is uncertain, since two parties in the Yukon Pacific proceeding, Alaskan Northwest Natural Gas Transportation Company and Foothills Pipe Line, Ltd., have applied for rehearing, either to overturn or to substantially amend the recent DOE Order. The current forecasts reflect an assumption that adequate North Slope supplies remain committed for U.S. domestic use, thus allowing for the expected construction and operation of the Alaskan Natural Gas Transportation System. Higher levels of exports are not included in this projection.

Imports of liquefied natural gas (LNG) serve as a major source of imports in the projection, growing from less than 100 billion cubic feet in 1989 to more than 700 billion cubic feet in 2010. Liquefaction is the only economically viable non-pipeline mode of transportation for natural gas in large volumes. Given the large natural gas reserves that are present in many parts of the world, estimated liquefaction and shipping capacity considerations are assumed to be the deciding factor for LNG imports through 2010.

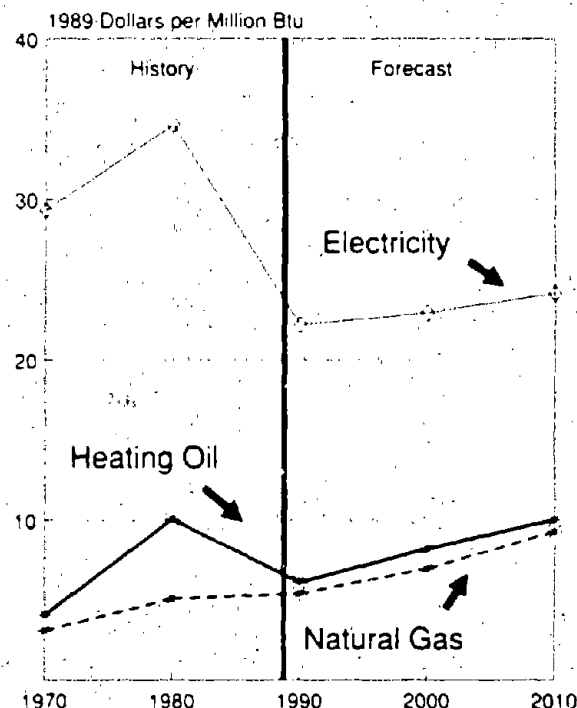
Delivered Gas Prices Remain Competitive

Natural gas prices to end users are expected to compare favorably with competing fuel prices, when comparing cost per million Btu (Figure 13). After adjusting for a high efficiency heat pump's roughly 3 to 1 advantage in efficiency over a conventional furnace, residential and commercial electricity prices also compete with natural gas, when valued per Btu. In the industrial and electric utility sectors, end-use prices will be influenced by prices of competing fuels, such as residual fuel and coal.

Coal

Coal became the largest source of U.S. energy production in the 1980's, and its role should continue to increase in the future. From 950 million short tons in 1988, annual coal production is expected to exceed 1 billion short tons by 1995, reaching 1.6 billion short tons in 2010 in the base case. Lower or higher economic growth driving electricity demand will cause this value to range from over 1.4 to 1.7 billion short tons in 2010. Increasing at a faster rate than total U.S. energy production over the forecast period, coal production in the base case should comprise about 42 percent of the Nation's primary energy production in

Residential Gas Prices Track Competing Fuels



Source: See data sources in Appendix G.

Figure 13. Selected Residential Energy Prices, Base Case, 1970-2010

2010, up from about 30 percent in 1988 (Figure 14). Depending on price and economic factors, coal could provide between 39 and 43 percent of primary energy production.

Coal's Contribution to Total Energy Requirements Grows Steadily

On the consumption side, coal meets more of the increased requirements in domestic energy than any other fuel over the forecast period. Nearly all of the increase is attributed to increased electric utility generation, whose share of U.S. coal consumption should rise to almost 90 percent by 2010. Mini-mills and new technologies such as continuous casting have substantially reduced the demand for coke for steelmaking. Although the demand for coke in conventional steelmaking is expected to remain strong, U.S. coking capacity will likely decline in the face of environmental regulations, which increase the cost of building and maintaining coke ovens. Consequently, an eventual decline in domestic coking coal demand

is expected. Other industrial coal consumption is projected to increase, driven by new demand for cogeneration and synthetic fuels. However, conventional demand for industrial steam coal will likely stagnate, leaving non-metallurgical industrial coal consumption with a slightly smaller share of total U.S. coal consumption in 2010 than in 1988.

Economic reforms in Europe, together with growth in electricity consumption worldwide, are expected to result in a surge in world coal trade. Additionally, U.S. steam coal exports should increase to countries such as West Germany and Japan, where planned nuclear projects have yet to materialize. U.S. coal exports should more than double between 1988 and 2010, reaching over 230 million short tons in the base case. However, given the uncertainty of the world economy and oil prices, coal exports could be as high as 292 million short tons or as low as 161 million short tons in 2010.

Coal Prices Grow by Less Than 1 Percent Annually

Although real minemouth coal prices will decline through 1990, the excess production capacity that has plagued the coal industry is anticipated to dissipate in the 1990's. From 1988-2010, real minemouth coal prices are projected to rise at an average annual rate of 1 percent. Because transportation costs will not rise as quickly, delivered (end-use) prices should increase at a somewhat lower rate. In the electric utility sector, real delivered coal prices are projected to rise by 0.9 percent per year, compared with 4.2 percent for heavy oil and 4.3 percent for natural gas.

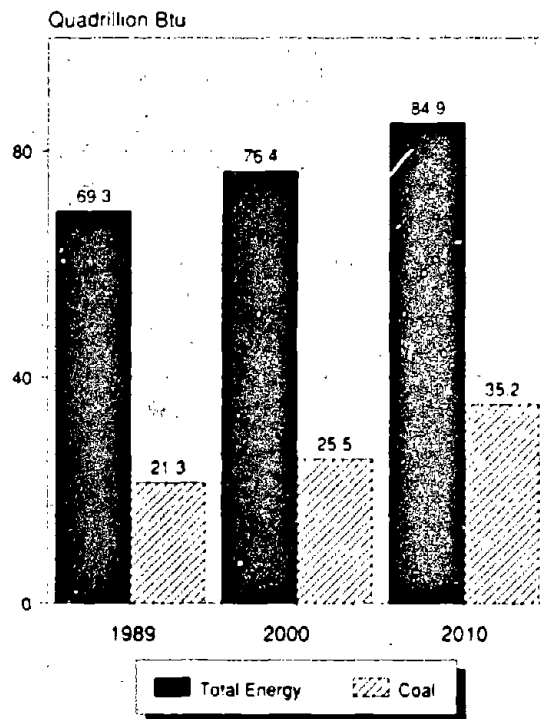
Environmental Concerns Cloud the Picture

The base case presented in this report assumes continuation of current laws and regulations. However the outlook for the U.S. coal industry could be affected significantly by proposed acid rain legislation, the development of clean coal technologies, and in the longer term, a resolution of the global warming debate. At this time, the exact nature, timing, interaction, and effects of these anticipated developments remain uncertain.

Electricity

Electric utilities throughout the United States are now exploring numerous options for providing a reliable supply of electricity into the next century. While most utilities have sufficient resources now, continuation of recent strong demand growth may accelerate the need to develop new resources. At this

Coal's Share of Total Energy Production Grows



Source: See data sources in Appendix G.

Figure 14. Coal Production and Total Energy Production, Base Case, 1989-2010

time, wary of being left with excess capacity if slow demand growth of the early 1980's returns, utilities are reluctant to consider building large central station power plants. Other options such as the life extension of existing capacity, the construction of smaller plants, increased purchases from nonutilities and foreign utilities, and a variety of demand side management programs are all being considered. The exact role to be played by each of these options is uncertain.

Demand Growth Has Many Utilities Guessing

The demand for electricity grew nearly 4.5 percent per year between 1986 and 1988, more than double the rate of growth in demand seen through the first half of the 1980's. Extreme weather conditions caused some of this rapid growth, and a strong economy boosted commercial and industrial demand growth. While few analysts expect this rate of demand growth to continue, some utilities are concerned that resource plans will have to be revised.

Over the next 20 years, the demand for electricity is expected to grow at 2.3 percent annually, ranging between 2.1 and 2.6 percent per year when lower or higher economic growth are assumed. Even with this modest growth in demand, electricity continues to capture an increasing share of the end-use market for energy. Relative to electricity, the demand for other end-use energy sources grows much more slowly. With present technological capability, electricity continues to be the fuel of choice for many applications.

Electricity demand in the industrial and commercial sectors is expected to grow more rapidly than in the residential sector, but at a lower rate than in recent years. In residential and commercial buildings, demand growth is expected to slow due to both improved building thermal efficiency and also improved heating and cooling equipment.

Supply Options are Numerous, But Planning is Difficult

The electric power industry will take advantage of numerous options for meeting demand growth. Through the early 1990's most utilities should be able to meet the increasing demand by completing the 46 gigawatts of capacity they have reported as currently planned, and extending the lives of their older plants so that they can be utilized more intensively. Few utilities are planning to retire much of their capacity. In fact, even assuming that small fossil-fuel steam plants under 100 MW are retired when they reach 45 years of age, less than 8 percent of the capacity existing today will be retired by 2010.

Utilities will also plan to increase their purchases of power from nonutilities, increase their use of renewable sources of power, initiate or expand demand side management programs, and import additional power from Canadian and Mexican utilities. Nonutilities should supply about 11 to 13 percent of the total demand (including self generation) for electricity in 2010. Nationwide, net power imports reduce utility generation requirements by less than 2 percent, although imports provide a much higher share of requirements in the Northeast and West. The use of innovative demand side management programs by utilities also lowers generation requirements by a small amount.

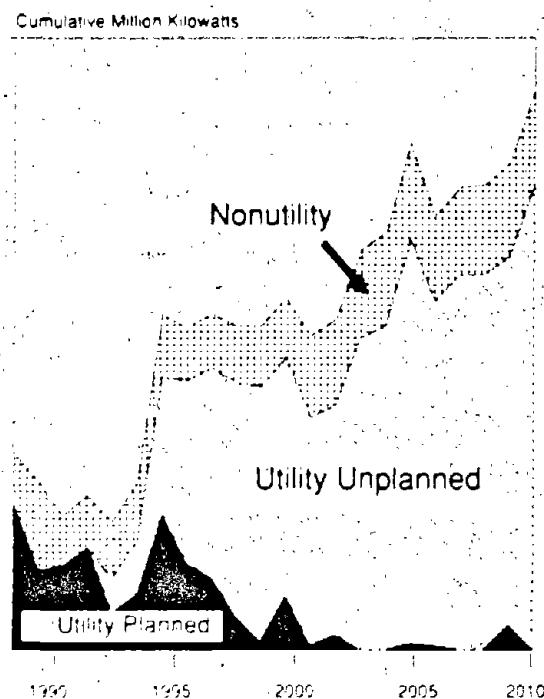
Utilities Will Need to Construct New Generating Plants, Environmental Concerns May Affect Decisions

Even with ongoing efforts to reduce generation requirements, utilities will need to construct approximately 234 gigawatts of capacity between 1989

and 2010 beyond what is currently reported as planned (Figure 15). With stronger economic growth even more new capacity would be needed, approximately 270 gigawatts, while lower economic growth would reduce this requirement to around 186 gigawatts. Between 112 to 158 gigawatts of currently unplanned capacity are expected to be coal-fired plants, while 35 to 67 gigawatts are combined-cycle plants (predominantly gas fired) and 28 to 35 are for turbines. Because many utilities currently have an excess of traditional large baseload plants (primarily coal-fired and nuclear), utilities are likely to build mostly combined-cycle and turbine units through 2000. Beyond 2000, however, demand growth should have eliminated the current excess of baseload capacity, and relatively low coal prices should make coal plants very competitive.

The exact types of fossil-fuel plants built between now and 2010 will be affected by the success of new plant technologies now being developed and tested. While not expected to penetrate the market

Major Additions of Capacity Are Required Beyond the Mid-1990's



Source: See data sources in Appendix G.

**Figure 15. Annual Additions of Electricity
Generating Capability, Base Case,
1989-2010**

significantly until after 2000, several emerging technologies, such as advanced gas-fired combined-cycle units, coal-fired fluidized bed units, and integrated gasification combined-cycle units offer significant improvements in performance and reduction of environmental impacts relative to existing technologies. While proposed revisions to the Clean Air Act are not addressed, growing concerns about acid rain and global warming could cause environmental emission considerations to have a large impact on utility capacity expansion decisions, particularly for coal-fired plants. In addition to improvements in fossil-fuel plant technology, continued advances in solar and wind turbine technology could make these units more economical in the near future as well.

Reliance on Natural Gas Grows in the Next 10 Years, but Coal Dominates in the Long Term

Between now and 2000, as utilities increase the use of existing and planned capacity, and add gas-fired combined-cycle and turbine units, the share of electricity produced from gas grows quickly. From 9 percent in 1989, the share of utility generation accounted for by gas-fired plants grows to 17 percent by 2000 in the base case, and from 15 to 19 percent by 2000 for lower and higher economic growth cases. Over the same time period, the share of utility generation provided by coal-fired plants declines slightly. However, after 2000 these shares decline.

As the turn of the century approaches and the need for additional capacity grows, relatively low coal prices will make new coal-fired plants economically attractive. With the increased use of existing coal-fired plants and the addition of many new units beginning in the late 1990's, the share of utility generation provided by coal increases rapidly, to around 60 percent in 2010. With no interim changes to Federal laws, the demand for coal after 2010 may increase even more rapidly, as the required decommissioning of the Nation's many aging nuclear plants begins.

Depreciation of Existing Capital and Increased Reliance on Coal Keep Electricity Prices Stable

Real electricity prices are forecast to remain relatively stable. Through 2000, the price impacts of increased reliance on higher cost fuels (oil and gas) are nearly offset by declining capital costs as existing plants are depreciated and used more intensively. As demand grows and few new plants are added, fixed capital costs can be recovered over a larger sales base. After 2000, increased reliance on relatively inexpensive coal

and increasing numbers of completely depreciated plants combine to restrain electricity price growth.

Nuclear Energy

The nuclear industry is completing construction of the present generation of reactors. During 1989, 3 units totaling 3.5 gigawatts-electric began operating, bringing the total number of operating units to 110. Only five units remain actively under construction, and they are projected to begin operation by 1995. An additional five units are in a deferred status and could be reactivated. Two of these units are projected to operate prior to 2010 due to the need for additional baseload power.

No New Construction Without Changes to Existing Laws and Regulations

Although electric utilities will need additional baseload capacity post-2000, no newly-ordered units are projected to begin operating through 2010 due to the underlying assumption that there will be no changes to existing laws and regulations. For a resumption of nuclear orders to occur, many believe that provisions for a combined construction and operating license must be legislated (even though the Nuclear Regulatory Commission (NRC) passed a rule in April 1989 on "Early Site Permits, Standardized Designs and Combined Licenses"). Many also believe that unlike the NRC rulemaking, the legislation should also allow third party intervention only up to the time of issuance of the combined license. It is also believed that appropriate regulatory action must occur at the State level to provide reasonable assurances for an adequate return on utility investments.

Life Extension Is Key to Continued Nuclear Supply

The same assumption that precludes new orders also precludes nuclear plant life extension. Under the base case assumption of no change in current laws, reactors retire upon the expiration of their current operating license of 40 years. Eleven units totaling over 5 gigawatts-electric retire by 2010. For plant life extension to occur, the duration of operating licenses must be extended by the Nuclear Regulatory Commission. There is considerable interest by utilities to extend the operating lives of their nuclear units by as much as 20 years. Even with the passage of a favorable Nuclear Regulatory Commission rulemaking on nuclear plant life extension, it is likely that not all units would be life extended. In fact, some units have been shut down prior to the expiration of their operating license.

In June 1989, the shareholders of Long Island Lighting Co., the principal owner of the Shoreham plant, voted to accept the agreement between the utility and the State of New York Power Authority in preparation for decommissioning. In August 1989, Public Service Co. of Colorado announced the permanent shutdown of the only commercial non-light-water-cooled reactor in the United States. The 217 megawatts-electric Fort Saint Vrain high-temperature gas-cooled reactor was scheduled for retirement at the end of its current fuel cycle in 1990, but continuing maintenance problems brought on its early closure. Studies are planned to consider the feasibility of converting the non-nuclear part of the plant to coal use. In September, the Board of Directors of the Sacramento Municipal Utility District (SMUD) voted to reject the only bid by an outside party to operate Rancho Seco as a nuclear unit, thus giving final confirmation to its retirement. In June 1989, voters of the district disapproved the continued operation of the unit by SMUD. This action followed a 1988 referendum in which continued operation was approved under certain conditions, including operation at a 70 percent utilization rate (capacity factor). The unit operated at a utilization rate of less than 50 percent during the period from October 1988 through May 1989.

Due to these factors that limit the growth of nuclear power during the projection period, the share of total electric generation, approximately 20 percent in 1989, is projected to decline through 2010 to 14 percent. The average utilization rate of nuclear units, however, which reached a record 63.5 percent in 1988, is projected to increase to 68.0 percent by 2010. For the first 9 months of 1989, the utilization rate was slightly less than in 1988.

Technological Advances are Proceeding

Although this forecast does not include new orders for nuclear units, the nuclear power industry, including the federal and private sector, has vigorously pursued new technology research and development, including the following programs: advanced light-water power plant program; modular high temperature gas-cooled reactor program; and the advanced liquid metal-cooled power plant program. It is expected that many of these new designs will have received advanced design certification by the NRC and be available when commercial ordering resumes. Most of these technologies incorporate automatically-activated safety systems.

Renewable Energy

Renewable energy consists of hydropower, geothermal, solar thermal, ocean thermal, photovoltaics, wind and

biofuels. Biofuels include wood, municipal and agricultural waste, landfill and sewer gas, methanol, and ethanol.

In 1988, renewable energy contributed 6.0 quadrillion Btu of the total 69.4 quadrillion Btu of primary energy produced in the United States, and, over 7 percent of the total energy consumed (see Table F2). By the year 2010, it is expected that renewables could contribute approximately 9 percent of total energy consumption. The principal forces driving the penetration of renewable energy are increasing conventional energy prices, decreasing delivered energy costs for renewable energy technologies, and increasing environmental concerns.

Electricity Generation Dominates Renewable Uses

Renewable energy is diverse in its applications and regional impacts. For electricity, plants can be owned by utilities, by independent power producers and cogenerators and sold to utilities, or used by industry for self-generation. Additionally, renewable energy forms are used for non-electric purposes, such as ethanol in the transportation sector or passive solar in the building sector or direct combustion of wood or waste. In 1988, 53 percent of renewable energy was used to generate electricity with the remainder being dispersed. Hydropower is by far the largest renewable contributor of electricity generation. Hydroelectric generation, which was abnormally low in 1988 because of the drought, is usually in the range of 3.3 quadrillion Btu.

Excluding hydropower, renewable electric capacity is projected to be almost four-times greater in 2010 (39.6 gigawatts) than 1988 (10.7 gigawatts). In 2010, over half of this capacity is expected to be biofuels based. Biofuels consist of wood, fuels manufactured from crops and waste, with waste being derived from either municipal solid waste (MSW), industrial process waste or landfill gas. MSW includes residential solid waste (ordinary household trash), commercial waste from office buildings, restaurants, institutions and supermarkets, and some nonhazardous industrial waste disposed of in the same manner as residential waste. Industrial process waste includes byproducts from manufacturing processes.

The United States contains large quantities of geothermal resources, which potentially can compete with today's conventional base load modes of electricity generation. The principal constraints for growth in geothermal is matching the geographical location of demand with the economical resources, the lack of advanced technology to permit the exploration of low-temperature resources, and the lack of nearby transmission lines.

Although electricity generation from wind, photovoltaics and solar thermal is expected to grow rapidly, the impacts are expected to be small by 2010, except in a few locations. Today, almost all of the wind, solar thermal and geothermal electric generation is in California. This is because of the state financial incentives, the favorable resources and the stringent environmental concerns.

The principal constraints to the penetration of wind, solar thermal and photovoltaic electric generation is their reliance on an intermittent resource; that is, they only generate electricity when an adequate amount of wind or sun is available. Thus, wind is seen primarily as a fuel saver in which the wind energy reduces the need for generation by conventional plants, while solar thermal and photovoltaics provide peaking and to some extent intermediate capacity in regions of good insolation. Current solar thermal plants rely on a backup fuel, and future photovoltaic and solar thermal plants will use thermal storage or batteries to smooth short-term fluctuations. All three technologies are expected to have significant cost reductions and become more competitive as the price of conventional sources of energy rise.

It is difficult to predict how much of the electricity generation from renewable sources will be owned by the utilities and how much of it will be sold to the utilities from independent power producers (IPP) and qualifying facilities (QF). It is expected that most of the early growth will occur in the IPP and QF market since private companies have economic advantages due to avoided cost pricing, allowing them to install new and more risky technologies. In the later years, utilities could be more interested in the ownership of renewable energy technologies as these technologies become more mature and reliable. This is especially

true if utilities can finance projects at lower interest costs than their competitors.

Non-Electricity Uses Dominated by Industrial and Residential Wood Use

Wood is by far the largest source of non-electric renewable energy. It is used primarily in the industrial sector by the Paper and Allied Products industry and the Lumber and Wood Products industry. The residential sector is also a large user of wood, accounting for one-third of the national wood energy consumption.

Another type of non-electric renewable energy use is alcohol as a substitute for gasoline. This analysis assumes most of the increase in alcohol will be in the use of octane enhancers and oxygenates (alcohols and alcohol-based ethers) for blending into motor gasoline. Oxygenate blending is expected to increase because of efforts to maintain high octane levels, reduce carbon monoxide and other emissions, and lower the aromatic content of gasoline. Fuels made up almost entirely of ethanol or methanol (85 percent ethanol/methanol and 15 percent gasoline, so-called neat fuels) are possible but require fuel-flexible engines. In the period from 1990 to 2010, there could be a slight penetration of neat fuels in the transportation sector.

Other types of non-electric renewable energy use include active and passive solar. Increased energy contribution from these technologies in the long term is anticipated based on more competitively priced systems. Increased energy contribution from passive solar technologies is anticipated, based on continuing development of high-performance window materials.

How this AEO Compares with Others

This chapter compares five alternate energy forecasts for the year 2010. It contrasts EIA's base case forecast published in this AEO with those of DRI/McGraw-Hill (DRI), the WEFA Group (WEFA), the Gas Research Institute (GRI) and the American Gas Association (AGA). The four non-EIA forecasts, which include two independent gas sector studies and two macroeconomic service studies, were chosen for comparison because they all provided estimates for 2010. We also considered other independent oil, electricity, and coal forecasts cited in the list of references; however they were not included in the comparison table either because they did not extend to the year 2010, or they provided insufficient detail for 2010. As all of the five forecasts we compared did not agree on estimates for 1989, we used 1988 data for the reference year.

Alternative Views on Oil Prices and Economic Growth

Similar on World Oil Prices, But Views on Other Energy Costs Vary

All five forecasts are based on a scenario of rapidly increasing oil prices after 1990 as non-OPEC crude production peaks and slowly declines. Decreased output from the major non-OPEC producers, particularly the United States and North Sea, will more than offset incremental annual increases in output from the other non-OPEC producers. The forecasts differ primarily on when and by how much energy prices will increase. Regarding the impact the oil price increase will have on the economy, there is general agreement that lower growth and higher inflation will be the main effect.

By 2010 the cost of oil, measured in 1989 dollars, is generally assumed to double. DRI, EIA, WEFA, and GRI's assumptions for oil price were similar, ranging from \$32.09 to \$36.90 (Table 3). AGA assumed the highest forecast of \$46.59. The world oil price assumptions of the five forecasts are generally reflected in the projected petroleum product prices. All of the forecasts projected a gradually tightening relationship between crude oil and natural gas over the forecast period, leading to higher natural gas prices.

WEFA's forecast shows higher electricity prices over the forecast period, reflecting expectations of needed capacity additions as well as the cost of future environmental regulations. DRI's projected average electricity price is also high relative to GRI and EIA's after 2000, when shortage of capacity is anticipated. EIA projects the lowest electricity prices, in line with

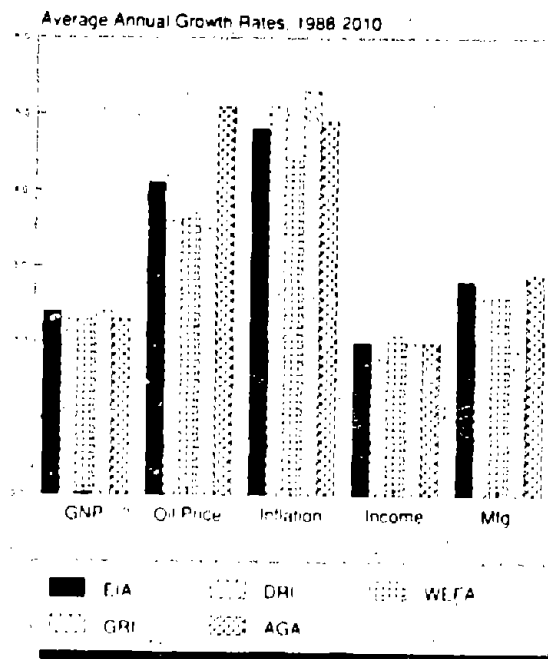
its projection of higher coal demand and relatively low coal prices.

Close Agreement on GNP

There is a consensus on the overall performance of the economy in 2010; two of the five forecasts assumed GNP growth of 2.4 percent, while the other three assumed the slightly lower rate of 2.3 percent (Figure 16). All the forecasts agreed that the rapid rise in oil price after 1990 will trigger slower GNP growth and higher rates of inflation, but slower population growth is a significant factor.

Projected estimates of inflation varied in a range of 4.4 to 5.3 percent, compared to the 1988 level of 3.3 percent. Oil prices are generally assumed to grow faster than inflation as slower economic growth serves to curb wage and price increases. Manufacturing production and real disposable personal income are both assumed to decline by roughly one-half their 1988 levels by all five forecasts.

Little Difference in Major Assumptions



Source: See data sources in Appendix G

Figure 16. Assumed Growth Rates for GNP, Oil Price, Inflation, Personal Income, and Manufacturing Production, 1988-2010

Table 3. Comparison of Energy Forecasts, 2010

	1988	EIA Base Case	DRI	WEFA	GRI	AGA
Prices (1989 dollars)						
World Oil Price (dollars per barrel)	15.27	36.90	32.09	33.59	33.68	46.59
Natural Gas Wellhead (dollars per thousand cubic feet)	1.76	5.63	4.48	5.12	5.10	4.47
Coal Minemouth (dollars per short ton)	23.02	28.55	29.56	36.12	n/a	n/a
Average Electricity Price (cents per kilowatthour)	6.62	7.01	8.84	9.56	7.08	7.57
Economic (annual percent)						
Real GNP Growth	4.4	2.4	2.3	2.3	2.4	2.3
Supply (Domestic Production)						
Petroleum (million barrels per day)	8.14	7.81	7.50	6.00	7.20	7.45
Natural Gas (trillion cubic feet)	16.99	20.00	16.17	15.86	18.05	18.54
Coal (million short tons)	950	1,617	1,337	1,484	n/a	n/a
Net imports						
Petroleum (million barrels per day)	6.59	12.35	12.64	14.78	13.40	10.56
Domestic Consumption						
Petroleum (million barrels per day)	17.28	20.32	20.85	20.58	20.60	18.00
Natural Gas (trillion cubic feet)	18.03	22.16	19.91	19.63	20.30	21.94
Coal (million short tons)	884	1,388	1,195	1,342	1,273	1,23
Electricity (quadrillion Btu)	8.80	14.63	12.40	13.87	12.60	14.70
U.S. Oil Import Dependence (Imports/Consumption)						
	38%	61%	61%	72%	65%	59%

Sources: See data sources in Appendix G.

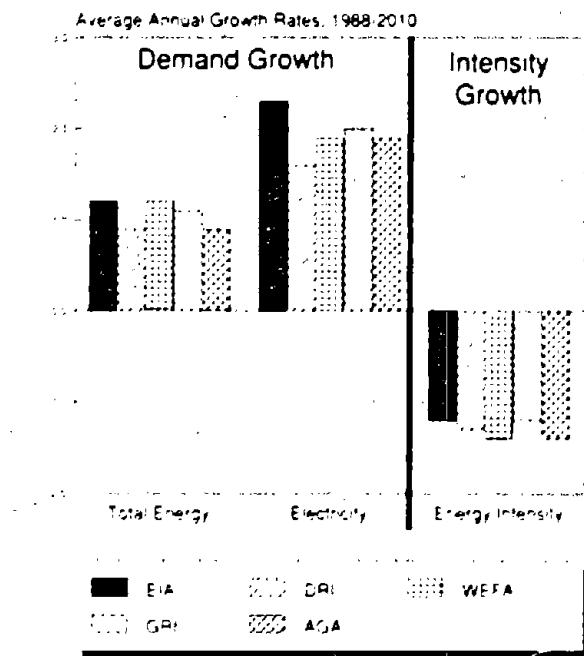
U.S. energy intensity (energy use per unit of GNP) is expected to decline at a rate of between -1.2 and -1.4 percent annually over the forecasts (Figure 17). The decline in energy intensity is directly related to GNP and electricity use, since electricity is the least efficient energy source. EIA and GRI, with the highest GNP and electricity demand, project similarly slower rates of decline in energy intensity. Conversely, WEFA and DRI, with relatively lower GNP and electricity use, show faster rates of decline in energy intensity.

Accompanying the decline in energy intensity are the continued improvements in the energy efficiency of motor vehicles, appliances and industrial equipment, as well as commercial buildings and residences.

A Narrow Range of Demand Forecasts

Forecasts of average total energy demand growth from 1988 to 2010 are fairly close, ranging from 0.9

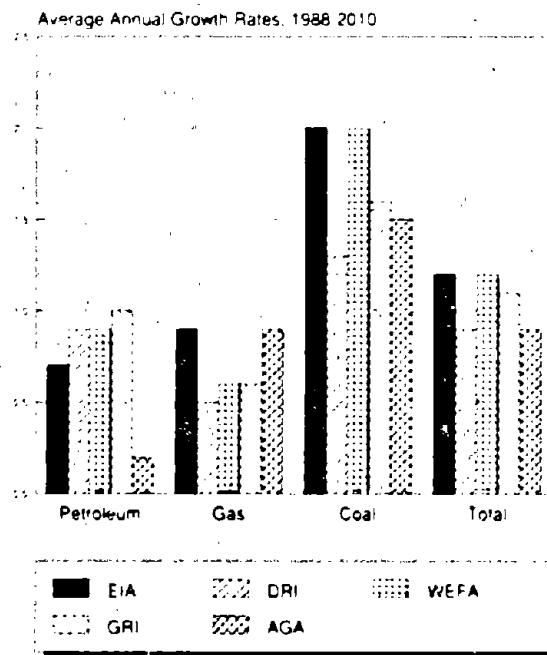
EIA Projections of Electricity Growth Are Highest



Source: See data sources in Appendix G.

Figure 17. Annual Growth Rates for Total Energy Demand, Electricity Demand, and Total Energy Intensity, 1988-2010

EIA Is Higher in Projection of Demand for Gas and Coal



Source: See data sources in Appendix G.

Figure 18. Change in Consumption of Major Energy Sources, 1988-2010

percent (AGA and DRI) to 1.2 percent (WEFA and EIA), with GRI in between (Figure 18). But, growth is uneven across the economic sectors and energy sources. There is a consensus among the forecasts that electricity and (as a result) coal are the fuels that will show the largest consumption increases, as demand shares for oil, gas, and nuclear decline.

Projections for electricity consumption range from a low of 12.4 quadrillion Btu (DRI) to a high of 14.7 quadrillion Btu (AGA). Electricity demand by the residential, commercial and industrial sectors is generally expected to grow faster than the demand for gas and oil.

Coal consumption will be driven mainly by power plant capacity additions and coal use is projected to rise almost twice as rapidly as overall U.S. total primary energy use by EIA and WEFA.

Declining Oil Supply, Rising Consumption and Imports in All Forecasts

In 1988, U.S. petroleum production was 8.1 million barrels per day and imports were 6.6 million barrels per day. In all forecasts for 2010 petroleum production is expected to continue its steady decline however those forecasts with the highest oil price assumptions generally had the highest production and lowest imports. WEFA at the low end of the price range, projected the lowest U.S. oil production at 6.0 million barrels per day. AGA, GRI, DRI and EIA are fairly close on production figures of between 7.2 and 7.8 million barrels per day. Expectations of net oil imports in 2010 range from a low of 10.6 (AGA) to a high of 14.8 million barrels per day (WEFA) and projected oil dependence ranges from 59 percent (AGA) to 72 percent (WEFA), compared to 38 percent in 1988.

References

American Gas Association, Total Energy Resource Analysis Model, The 1989 AGA-TERA Base Case (April 7, 1989).

Conoco, *World Energy Outlook Through 2000* (1989).

Edison Electric Institute, *Electricity Futures: America's Economic Imperative* (January 1989).

DRI/McGraw-Hill, *Energy Review* (Autumn 1989).

Gas Research Institute, *1989 GRI Baseline Projection of U.S. Energy Supply and Demand* (1989).

National Coal Association, *Coal: Energy for the Next Decade and Beyond* (February 1989).

The WEFA Group, *Energy Analysis Quarterly* (Fall 1989) and *U.S. Long-Term Economic Outlook* (Third Quarter 1989).

Appendix A

Base Case Forecasts

- **Resource Prices, Economic Growth, and Energy Efficiency**
- **Total Energy Supply, Disposition, and Prices**
- **Petroleum Supply, Disposition, and Prices**
- **Natural Gas Supply, Disposition, and Prices**
- **Coal Supply, Disposition, and Prices**
- **Electricity Supply, Disposition, and Prices**
- **Electricity Generating Capability**
- **Residential Consumption and Price of Energy by Fuel**
- **Commercial Consumption and Price of Energy by Fuel**
- **Transportation Consumption and Price of Energy by Fuel**
- **Industrial Consumption and Price of Energy by Fuel**

Table A1. Resource Prices, Economic Growth, and Energy Efficiency: BASE

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Prices								
World Oil Price ^a (1989 dollars per barrel)	15.27	17.70	16.80	20.40	27.80	32.90	36.90	4.1%
Domestic Natural Gas Wellhead (1989 dollars per 1,000 cubic feet)	1.76	1.78	1.81	2.25	3.23	4.36	5.63	5.4%
Domestic Coal Minemouth (1989 dollars per short ton)	23.02	22.85	22.76	23.44	24.67	26.60	28.55	1.0%
Economic Indicators ^b								
Real Gross National Product (billion 1982 dollars)	4,024	4,139	4,214	4,783	5,392	6,066	6,799	2.4%
Percentage Change from Prior Year	4.4%	2.9%	1.8%	3.0%	2.0%	2.6%	2.1%	
GNP Implicit Price Deflator (index 1982=1.000)	1.213	1.265	1.317	1.648	2.101	2.656	3.399	4.8%
Percentage Change from Prior Year	3.3%	4.3%	4.1%	4.8%	5.0%	4.8%	5.2%	
Real Disposable Personal Income (billion 1982 dollars)	2,793	2,902	2,935	3,226	3,562	3,925	4,358	2.0%
Percentage Change from Prior Year	4.3%	3.9%	1.1%	2.3%	1.8%	2.2%	1.9%	
Index of Manufacturing Production (index 1982=1.000)	1.219	1.244	1.257	1.470	1.713	1.949	2.231	2.8%
Percentage Change from Prior Year	5.0%	2.0%	1.1%	3.4%	2.8%	2.7%	2.9%	
Energy Efficiency (thousand Btu per 1982 dollar of GNP)								
Oil & Gas Use	13.12	12.80	12.72	11.99	11.27	10.18	9.23	-1.6%
Electricity Use	2.19	2.15	2.18	2.20	2.21	2.18	2.15	-0.1%
Total Energy Use	20.72	20.34	20.27	19.21	18.07	16.94	15.95	-1.2%

^a Cost of imported crude oil to U.S. refiners.

^b Seasonally adjusted at annual rates.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); U.S. Department of Commerce (DoC), Bureau of Economic Analysis, *Survey of Current Business*, July 1989; DoC, Office of Business Analysis; PC-AEO Run DACB212, 01/03/90.

Table A2. Total Energy Supply, Disposition, and Prices: BASE

Supply and Disposition	1988	1989	1990	1995	2000	2005	2010	Annual Percent Growth 1988-2010
Energy Summary (Quadrillion Btu)								
Primary Production								
Petroleum	19.5	18.5	17.9	16.0	15.1	14.0	12.7	-1.9%
Natural Gas	17.5	17.4	17.8	19.4	21.2	20.9	20.4	0.7%
Coal	20.7	21.3	21.6	23.5	25.5	29.9	35.2	2.4%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy ^a	6.0	6.5	6.8	7.7	8.3	9.2	10.1	2.4%
Total Production	69.4	69.3	69.9	72.7	76.4	80.4	84.9	0.9%
Net Imports								
Petroleum (including SPR)	13.9	15.2	16.1	19.3	21.0	23.4	26.0	2.9%
Natural Gas	1.2	1.3	1.4	2.1	2.7	2.9	2.9	4.1%
Coal/Other (- indicates export) ^b	-2.1	-2.2	-2.1	-2.1	-2.6	-3.5	-4.9	4.0%
Total Net Imports	13.1	14.3	15.4	19.2	21.1	22.8	24.1	2.8%
Consumption								
Petroleum Products	34.2	34.1	34.4	36.0	37.2	38.3	39.9	0.7%
Natural Gas	18.6	18.9	19.2	21.3	23.6	23.4	22.8	0.9%
Coal	18.8	19.0	19.0	20.7	22.0	25.2	28.9	2.0%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy/Other ^c	6.1	6.6	6.9	7.7	8.5	9.4	10.3	2.4%
Total Consumption ^d	83.4	84.2	85.4	91.9	97.4	102.8	108.4	1.2%
Discrepancy ^e	-0.9	-0.6	-0.1	0.0	0.0	0.5	0.5	
End-Use Prices (1989 dollars per million Btu)								
Residential								
Heating Oil	6.05	6.20	6.11	6.99	8.20	9.21	10.02	2.3%
Natural Gas	5.53	5.49	5.41	6.01	6.96	8.05	9.27	2.4%
Electricity	22.86	22.41	22.19	22.38	22.94	23.74	24.14	0.2%
Industrial								
Residual Fuel Oil	2.22	2.46	2.49	3.19	4.47	5.31	5.98	4.6%
Natural Gas	2.97	2.89	3.00	3.37	4.35	5.44	6.63	3.7%
Transportation								
Motor Gasoline	8.03	8.51	8.38	8.95	10.47	11.37	12.04	1.9%
Diesel Oil	6.84	6.95	6.69	7.55	8.76	9.76	10.56	2.0%
Electric Utilities								
Coal	1.54	1.46	1.47	1.59	1.66	1.76	1.86	0.9%
Heavy Oil	2.52	2.78	2.75	3.48	4.70	5.54	6.21	4.2%
Natural Gas	2.36	2.36	2.39	2.90	3.83	4.92	6.00	4.3%

^a Includes utility and nonutility generation of hydroelectric power; geothermal, wood, waste, wind, photovoltaic, and solar thermal sources for electricity generation; and renewables consumed for non-electric purposes.

^b Includes coal, net coal coke imports, and net electricity imports (fuel input equivalent).

^c Same as footnote a, plus net electricity imports and net coal coke imports, and minus biofuels for transportation.

^d Includes 3.1 quadrillion Btus of renewable energy in 1988 that are not reported in EIA's *Monthly Energy Review*.

^e A balancing item. Includes stock changes, unaccounted for supply, losses, and gains.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run DACB212, 01/03/90.

Table A3. Petroleum Supply, Disposition, and Prices: BASE
(Quantities in Million Barrels per Day)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Petroleum Production								
Crude Oil	8.14	7.67	7.37	6.40	5.86	5.35	4.78	-2.4%
Alaska	2.02	1.87	1.84	1.28	0.96	0.65	0.46	-6.5%
Lower 48 States	6.12	5.79	5.54	5.12	4.90	4.70	4.33	-1.6%
Natural Gas Liquids	1.62	1.60	1.62	1.78	1.95	1.92	1.87	0.6%
Other *	0.71	0.71	0.73	0.80	0.90	1.03	1.18	2.4%
Total Production	10.47	9.97	9.71	8.97	8.71	8.29	7.83	-1.3%
Net Imports (including SPR)								
Crude Oil	4.95	5.69	5.94	7.32	8.09	9.13	10.38	3.4%
Refined Products	1.63	1.51	1.67	1.80	1.86	1.90	1.95	0.8%
Total Net Imports	6.59	7.20	7.61	9.13	9.95	11.02	12.33	2.9%
Net Storage Withdrawals *								
Crude Oil and Products (excl. SPR)	0.08	-0.03	0.00	0.01	0.03	0.00	0.01	-8.9%
SPR Fill Rate (-)	-0.05	-0.06	-0.05	-0.05	0.00	0.00	0.00	
Petroleum Product Supplied								
Motor Gasoline	7.34	7.34	7.41	7.52	7.71	7.99	8.38	0.6%
Jet Fuel	1.45	1.48	1.50	1.62	1.73	1.85	1.97	1.4%
Distillate Fuel	3.12	3.12	3.17	3.29	3.38	3.50	3.68	0.8%
Residual Fuel	1.38	1.31	1.19	1.47	1.49	1.40	1.32	-0.2%
Liquefied Petroleum Gases	1.66	1.70	1.77	1.86	2.03	2.14	2.28	1.5%
Other *	2.34	2.30	2.37	2.45	2.51	2.59	2.68	0.6%
Total Products Supplied	17.28	17.24	17.41	18.21	18.84	19.47	20.32	0.7%
Unaccounted for ^b	0.20	0.17	0.14	0.15	0.15	0.15	0.15	
World Oil Price * (1989 dollars per barrel)	15.27	17.70	16.80	20.40	27.80	32.90	36.90	4.1%
End-Use Prices (1989 dollars per gallon)								
Motor Gasoline (incl. tax)	1.00	1.06	1.05	1.12	1.31	1.42	1.51	1.9%
Propane	0.54	0.53	0.55	0.53	0.56	0.65	0.74	1.5%
Jet Fuel	0.53	0.56	0.54	0.67	0.85	1.00	1.12	3.5%
No. 2 Heating Oil	0.84	0.86	0.85	0.97	1.14	1.28	1.39	2.3%
Residual Fuel (dollars per barrel)	14.65	16.29	16.26	20.94	28.73	33.91	38.02	4.4%

* Includes refinery processing gain, and other hydrocarbons and alcohol.

* A negative (-) result represents an increase to inventories and a decrease to total supply.

* Includes crude oil supplied as product, unfinished oils, and all other finished petroleum products not noted here.

* A balancing item: unaccounted for crude oil supply.

* Cost of imported crude oil to U.S. refiners.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); PC-AEO Run DACB212, 01/03/90.

Table A4. Natural Gas Supply, Disposition, and Prices: BASE
(Quantities in Trillion Cubic Feet)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Natural Gas Production								
Dry Gas Production	16.99	16.91	17.25	18.84	20.58	20.24	19.76	0.7%
Supplemental Gas ^a	0.10	0.16	0.18	0.12	0.13	0.19	0.25	4.2%
Net Imports	1.22	1.26	1.43	2.07	2.68	2.95	2.95	4.1%
Net Storage Withdrawals ^b	0.06	0.04	0.01	0.00	0.00	0.00	0.00	
Consumption by Sector								
Residential	4.63	4.64	4.78	4.69	4.67	4.64	4.59	0.0%
Commercial	2.67	2.62	2.66	2.65	2.59	2.55	2.52	-0.3%
Industrial	6.38	6.69	6.80	7.20	7.29	7.18	7.13	0.5%
Electric Utilities	2.64	2.66	2.60	4.17	6.16	6.24	5.86	3.7%
Lease and Plant Fuel	1.10	1.15	1.17	1.32	1.44	1.42	1.38	1.1%
Pipeline Fuel	0.61	0.59	0.65	0.66	0.72	0.71	0.69	0.5%
Total Consumption	18.03	18.34	18.66	20.69	22.88	22.72	22.16	0.9%
Unaccounted for ^c	0.34	0.03	0.20	0.33	0.51	0.66	0.79	
Average Wellhead Price (1989 dollars per 1,000 cubic feet)	1.76	1.78	1.81	2.25	3.23	4.36	5.63	5.4%
End-Use Prices (1989 dollars per 1,000 cubic feet)								
Residential	5.70	5.66	5.58	6.20	7.18	8.30	9.56	2.4%
Commercial	4.83	4.78	4.85	5.33	6.32	7.45	8.71	2.7%
Industrial	3.06	2.98	3.10	3.47	4.48	5.61	6.83	3.7%
Electric Utilities	2.43	2.44	2.47	2.99	3.95	5.07	6.18	4.3%
Average to All Sectors ^d	4.00	3.92	3.98	4.31	5.16	6.28	7.50	2.9%

^a Includes synthetic natural gas (results from the manufacture, conversion, or reforming of petroleum and coal hydrocarbons), and propane-air mixtures.

^b Includes net withdrawals of dry natural gas from underground storage and liquefied natural gas. A negative (-) result represents an increase to inventories and a decrease to total supply. A positive result represents a withdrawal from inventories and an increase to total supply.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Weighted average price. Weights used are consumption values by sector, excluding lease and plant fuel and pipeline use.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Natural Gas Monthly*, DOE/EIA-0130(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); PC-AEO Run DACB212, 01/03/90.

Table A5. Coal Supply, Disposition, and Prices: BASE
(Quantities in Million Short Tons)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Coal Production ^a	950	973	987	1,085	1,178	1,379	1,617	2.4%
Net Imports (- indicates exports)	-93	-95	-92	-99	-126	-165	-220	4.0%
Imports	2	2	2	5	8	10	12	8.2%
Exports	95	97	95	104	133	175	232	4.1%
Net Storage Withdrawals ^b	25	11	-2	-2	-3	-7	-8	
Consumption by Sector								
Residential/Commercial	7	6	6	6	5	5	4	-2.6%
Industrial								
Coke Plants	42	42	41	43	39	36	34	-1.0%
Other Industrial	76	77	77	80	83	91	112	1.8%
Electric Utilities	758	759	769	856	922	1074	1238	2.3%
Total Consumption	883	884	893	984	1,049	1,207	1,388	2.1%
Discrepancy ^c	-1	5	0	0	0	0	0	
Average Minemouth Price (1989 dollars per short ton) ^d	23.02	22.85	22.76	23.44	24.67	26.60	28.55	1.0%
End-Use Prices (1989 dollars per short ton)								
Residential/Commercial	49.57	48.76	48.65	50.77	52.95	55.81	58.54	0.8%
Coke Plants	49.74	49.32	49.26	50.97	53.35	56.40	59.48	0.8%
Other Industrial	34.86	34.39	34.40	35.48	36.95	39.02	41.03	0.7%
Electric Utilities	31.98	30.76	30.95	32.84	34.14	36.16	38.18	0.8%
Average to All Sectors ^e	33.22	32.09	32.22	33.95	35.17	37.06	38.98	0.7%

^a Includes anthracite, bituminous coal, and lignite.

^b From all stocks held by industrial plants, coke plants, electric utilities, and producers/distributors. A negative (-) result represents an increase to inventories. A positive result represents a withdrawal from inventories.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Free-on-board price.

^e Weighted average prices. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Quarterly Coal Report*, DOE/EIA-0121(89/2Q); *Coal Production 1988*, DOE/EIA-0118(88); PC-AEO Run DACB212, 01/03/90.

**Table A6. Electricity Supply, Disposition, and Prices: BASE
(Generation in Billion Kilowatthours)**

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Electric Utilities								
Generation by Fuel Type								
Coal	1,538	1,532	1,561	1,711	1,835	2,158	2,576	2.4%
Petroleum	149	151	130	186	198	175	151	0.1%
Natural Gas	253	254	249	388	608	625	603	4.0%
Nuclear Power	527	521	550	558	572	592	595	0.6%
Pumped/Other Storage ^a	.9	.9	.9	-10	-10	-11	-12	1.3%
Hydropower/Other ^b	244	291	315	320	322	336	351	1.7%
Total Generation^c	2,702	2,740	2,795	3,153	3,524	3,875	4,264	2.1%
Net Imports	32	26	27	46	60	64	68	3.5%
Nonutility Purchases	69	74	88	139	204	271	334	7.4%
Electricity Sales by Sector								
Residential	895	890	927	1,046	1,156	1,255	1,354	1.9%
Commercial/Other ^d	785	818	853	987	1,121	1,264	1,414	2.7%
Industrial	900	903	909	1,049	1,211	1,350	1,521	2.4%
Total Electricity Sales^e	2,580	2,612	2,689	3,083	3,488	3,870	4,289	2.3%
Nonutilities								
Generation by Fuel Type								
Coal	28	31	34	45	57	91	126	7.1%
Petroleum	4	5	5	7	8	10	12	4.8%
Natural Gas	76	84	98	122	148	176	204	4.6%
Other Fossil ^f	12	12	12	13	13	14	15	1.0%
Pumped/Other Storage ^a	0	0	0	0	0	-1	-2	
Renewable Sources ^g	59	60	61	90	123	156	189	5.5%
Total Generation^c	178	192	211	278	351	446	544	5.4%
Sales to Utilities	69	74	88	139	204	271	334	7.4%
Generation for Own Use	109	118	123	139	147	175	210	3.0%
End-Use Prices (1989 cents per kilowatthour)								
Residential	7.80	7.65	7.57	7.64	7.83	8.10	8.24	0.2%
Commercial	7.26	7.10	7.03	7.07	7.27	7.54	7.68	0.3%
Industrial	4.91	4.80	4.75	4.70	4.88	5.16	5.30	0.4%
Average to All Sectors^h	6.62	6.49	6.45	6.45	6.62	6.89	7.01	0.3%

^a Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^b "Other" includes geothermal, petroleum coke, biomass, wood, waste, solar, and wind.

^c Includes transmission and distribution losses.

^d "Other" includes sales of electricity to Government, railways, and street lighting authorities.

^e Total is lower by 171 billion kilowatthours in 2010 because of demand side management programs.

^f Includes petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, non-fossil waste, solar, and wind.

^h Weighted average price, including transportation. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels: PC-AEO Run DACB212, 01/03/90.

Table A7. Electricity Generating Capability: BASE
(Million Kilowatts)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Electric Utility Capability								
Net Summer Capability ^a								
Coal Steam	294.6	296.6	297.0	300.3	313.3	364.4	433.9	1.8%
Other Fossil Steam	144.6	144.3	144.2	137.0	130.5	123.8	120.1	-0.8%
Combined Cycle ^b	4.9	5.0	5.1	11.4	42.0	49.5	58.2	11.9%
Turbine/Diesel	44.5	45.9	46.1	55.6	70.8	76.9	84.5	3.0%
Nuclear	94.7	97.0	99.3	102.8	103.8	103.8	99.7	0.2%
Pumped/Other Storage ^c	17.0	17.0	17.0	19.5	19.5	21.0	22.5	1.3%
Hydroelectric/Other ^d	77.6	77.7	77.9	79.1	80.0	82.1	84.6	0.4%
Total Utility Capability	677.9	683.4	686.6	705.8	759.9	821.6	903.5	1.3%
Cumulative Planned Additions ^e								
Coal Steam	0.0	2.0	3.0	10.5	15.9	16.9	17.2	
Other Fossil Steam	0.0	0.0	0.0	0.5	0.6	0.6	0.6	
Combined Cycle ^b	0.0	0.0	0.1	2.5	3.0	3.0	3.0	
Turbine/Diesel	0.0	1.5	1.7	4.3	8.9	9.1	9.1	
Nuclear	0.0	3.4	5.7	9.2	10.4	10.4	11.6	
Pumped/Other Storage ^c	0.0	0.0	0.0	2.5	2.5	2.5	2.5	
Hydroelectric/Other ^d	0.0	0.2	0.4	1.7	2.2	2.2	2.2	
Total Planned Additions	0.0	7.1	11.0	31.2	43.5	44.7	46.1	
Cumulative Unplanned Additions ^f								
Coal Steam	0.0	0.0	0.0	0.0	13.6	67.3	140.1	
Combined Cycle ^b	0.0	0.0	0.0	3.9	34.0	41.6	50.2	
Turbine/Diesel	0.0	0.0	0.0	7.2	18.1	25.3	32.9	
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Pumped/Other Storage ^c	0.0	0.0	0.0	0.0	0.0	1.5	3.0	
Hydroelectric/Other ^d	0.0	0.0	0.0	0.0	0.3	4.0	7.9	
Total Unplanned Additions	0.0	0.0	0.0	11.1	66.1	139.6	234.2	
Cumulative Retirements ^g	0.0	1.5	2.3	14.4	27.5	40.6	54.7	
Nonutility Capability								
Coal	5.4	6.0	6.8	9.2	11.8	18.9	26.4	7.5%
Natural Gas	12.2	13.9	17.0	21.5	26.3	31.5	36.7	5.1%
Other Fossil ^h	4.0	4.2	4.5	5.2	6.0	7.2	8.2	3.3%
Renewable Sources/Other ⁱ	9.8	10.0	10.2	16.4	22.4	30.8	39.2	6.5%
Total Nonutility Capability	31.5	34.1	38.5	52.4	66.5	88.4	110.5	5.9%

^a The steady hourly output that generating equipment may supply to system load during summer peak demand.

^b Includes natural gas, oil, and dual-fired oil/natural gas combined cycle capability.

^c Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^d Includes geothermal, wood, waste, solar, and wind.

^e Cumulative additions from December 31, 1988.

^f Includes petroleum, petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, nonfossil waste, solar and wind, and pumped/other storage.

Source: Energy Information Administration, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run DACB212, 01/03/90.

Table A8. Residential Consumption and Price of Energy by Fuel: BASE

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	1.08	1.02	1.03	0.83	0.72	0.66	0.61	-2.5%
Liquefied Petroleum Gas	0.43	0.44	0.46	0.35	0.29	0.24	0.21	-3.3%
Natural Gas	4.77	4.78	4.92	4.84	4.82	4.78	4.73	0.0%
Electricity	3.05	3.04	3.16	3.57	3.94	4.28	4.62	1.9%
Renewables	0.92	0.93	0.93	0.98	1.05	1.12	1.20	1.2%
Other *	0.16	0.16	0.16	0.18	0.19	0.20	0.21	1.2%
Total	10.42	10.37	10.67	10.75	11.01	11.29	11.58	0.5%
Prices (1989 dollars per million Btu)								
Distillate	6.05	6.20	6.11	6.99	8.20	9.21	10.02	2.3%
Liquefied Petroleum Gas	8.81	8.57	8.91	8.88	9.34	10.44	11.60	1.3%
Natural Gas	5.53	5.49	5.41	6.01	6.96	8.05	9.27	2.4%
Electricity	22.86	22.41	22.19	22.38	22.94	23.74	24.14	0.2%

* Includes kerosene and steam coal.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACB212, 01/03/90.

Table A9. Commercial Consumption and Price of Energy by Fuel: BASE

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	0.62	0.59	0.59	0.52	0.45	0.40	0.38	-2.2%
Natural Gas	2.75	2.70	2.75	2.73	2.68	2.62	2.60	-0.3%
Electricity	2.66	2.78	2.90	3.35	3.81	4.30	4.80	2.7%
Other *	0.59	0.56	0.54	0.49	0.46	0.43	0.41	-1.6%
Total	6.63	6.62	6.77	7.10	7.39	7.76	8.20	1.0%
Prices (1989 dollars per million Btu)								
Distillate	4.73	4.85	4.78	5.63	6.82	7.81	8.61	2.8%
Natural Gas	4.69	4.64	4.70	5.17	6.13	7.22	8.45	2.7%
Electricity	21.26	20.81	20.60	20.73	21.29	22.10	22.51	0.3%

* Includes kerosene, motor gasoline, residual fuel, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10);

State Energy Price and Expenditure Report, 1985, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACB212, 01/03/90.

Table A10. Transportation Consumption and Price of Energy by Fuel: BASE

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	3.53	3.61	3.76	4.10	4.44	4.77	5.15	1.7%
Jet Fuel	2.98	3.03	3.08	3.33	3.55	3.79	4.05	1.4%
Motor Gasoline	13.78	13.76	13.88	14.05	14.40	14.91	15.61	0.6%
Residual Fuel	0.80	0.72	0.68	0.75	0.82	0.90	0.99	0.9%
Other *	0.92	0.89	0.97	1.00	1.10	1.11	1.12	0.9%
Total	22.02	22.01	22.36	23.23	24.30	25.49	26.92	0.9%
Prices (1989 dollars per million Btu)								
Distillate	6.84	6.95	6.69	7.55	8.76	9.76	10.56	2.0%
Jet Fuel	3.96	4.21	4.04	5.01	6.36	7.49	8.39	3.5%
Motor Gasoline	8.03	8.51	8.38	8.95	10.47	11.37	12.04	1.9%
Residual Fuel	2.10	2.33	2.36	2.06	4.34	5.18	5.84	4.8%

* Includes kerosene, electricity, liquefied petroleum gas, lubricants, waxes, natural gas and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACB212, 01/03/90.

Table A11. Industrial Consumption and Price of Energy by Fuel: BASE

	Year						Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010
Consumption (Quadrillion Btu)							
Distillate	1.32	1.29	1.26	1.38	1.41	1.43	1.50
Liquefied Petroleum Gas	1.66	1.70	1.77	2.01	2.30	2.50	2.71
Petrochemical Feedstocks	0.94	0.93	0.95	1.10	1.23	1.35	1.50
Residual Fuel	0.67	0.60	0.56	0.53	0.49	0.49	0.51
Natural Gas	7.71	8.08	8.21	8.79	9.01	8.86	8.77
Metallurgical Coal	1.08	1.04	1.11	1.14	1.06	0.97	0.90
Steam Coal	1.69	1.69	1.71	1.75	1.81	1.98	2.43
Electricity	3.07	3.08	3.10	3.58	4.13	4.61	5.19
Renewables	2.43	2.45	2.46	2.94	3.45	3.95	4.44
Other*	4.01	3.98	4.16	4.16	4.14	4.15	4.19
Total	24.57	24.83	25.30	27.40	29.01	30.29	32.15
Prices (1989 dollars per million Btu)							
Distillate	4.36	4.47	4.40	5.27	6.47	7.47	8.28
Liquefied Petroleum Gas	5.43	5.27	5.49	5.54	6.01	7.09	8.23
Residual Fuel	2.22	2.46	2.49	3.19	4.47	5.31	5.98
Natural Gas	2.97	2.89	3.00	3.37	4.35	5.44	6.63
Metallurgical Coal	1.85	1.84	1.84	1.90	1.99	2.10	2.22
Steam Coal	1.56	1.55	1.55	1.62	1.70	1.80	1.90
Electricity	14.38	14.07	13.93	13.76	14.31	15.12	15.53

* Includes kerosene, liquefied petroleum gas, lubricants, waxes, motor gasoline, and hydropower.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACB212, 01/03/90.

Appendix B

Low Oil Price Case Forecasts

- **Resource Prices, Economic Growth, and Energy Efficiency**
- **Total Energy Supply, Disposition, and Prices**
- **Petroleum Supply, Disposition, and Prices**
- **Natural Gas Supply, Disposition, and Prices**
- **Coal Supply, Disposition, and Prices**
- **Electricity Supply, Disposition, and Prices**
- **Electricity Generating Capability**
- **Residential Consumption and Price of Energy by Fuel**
- **Commercial Consumption and Price of Energy by Fuel**
- **Transportation Consumption and Price of Energy by Fuel**
- **Industrial Consumption and Price of Energy by Fuel**

Table B1. Resource Prices, Economic Growth, and Energy Efficiency: LOW OIL PRICE

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Prices								
World Oil Price ^a (1989 dollars per barrel)	15.27	17.10	14.40	14.30	19.80	23.90	25.90	2.4%
Domestic Natural Gas Wellhead (1989 dollars per 1,000 cubic feet)	1.76	1.71	1.61	2.14	3.03	3.83	4.59	4.5%
Domestic Coal Minemouth (1989 dollars per short ton)	23.02	22.85	22.89	23.86	25.23	26.96	28.66	1.0%
Economic Indicators ^b								
Real Gross National Product (billion 1982 dollars)	4,024	4,139	4,214	4,900	5,456	6,160	6,921	2.5%
Percentage Change from Prior Year	4.4%	2.9%	1.8%	3.3%	1.9%	2.6%	2.1%	
GNP Implicit Price Deflator (index 1982=1.000)	1.213	1.265	1.317	1.640	2.120	2.673	3.416	4.8%
Percentage Change from Prior Year	3.3%	4.3%	4.1%	4.9%	5.1%	4.7%	5.2%	
Real Disposable Personal Income (billion 1982 dollars)	2,793	2,902	2,935	3,280	3,594	3,957	4,408	2.1%
Percentage Change from Prior Year	4.3%	3.9%	1.1%	2.5%	1.6%	2.2%	1.9%	
Index of Manufacturing Production (index 1982=1.000)	1.219	1.244	1.257	1.516	1.735	1.988	2.285	2.9%
Percentage Change from Prior Year	5.0%	2.0%	1.1%	3.8%	2.6%	2.8%	2.9%	
Energy Efficiency (thousand Btu per 1982 dollar of GNP)								
Oil & Gas Use	13.12	12.80	12.76	12.11	11.51	10.48	9.63	-1.4%
Electricity Use	2.19	2.16	2.21	2.19	2.22	2.18	2.15	-0.1%
Total Energy Use	20.72	20.34	20.32	19.18	18.32	17.20	16.25	-1.1%

^a Cost of imported crude oil to U.S. refiners.

^b Seasonally adjusted at annual rates.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); U.S. Department of Commerce (DoC), Bureau of Economic Analysis, *Survey of Current Business*, July 1989; DoC, Office of Business Analysis; PC-AEO Run DACC488, 01/03/90.

Table B2. Total Energy Supply, Disposition, and Prices: LOW OIL PRICE

Supply and Disposition	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Energy Summary (Quadrillion Btu)								
Primary Production								
Petroleum	19.5	18.4	17.6	14.5	12.8	12.1	11.3	-2.5%
Natural Gas	17.5	17.4	17.4	18.9	20.4	20.6	20.0	0.6%
Coal	20.7	21.3	21.7	23.6	26.1	30.2	35.2	2.4%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy ^a	6.0	6.5	6.8	7.7	8.3	9.2	10.1	2.4%
Total Production	69.4	69.2	69.3	70.8	73.7	78.5	83.0	0.8%
Net Imports								
Petroleum (including SPR)	13.9	15.5	17.1	22.7	25.7	28.1	31.8	3.8%
Natural Gas	1.2	1.3	1.4	2.1	2.7	2.9	2.9	4.1%
Coal/Other (- indicates export) ^b	-2.1	-2.2	-2.1	-2.2	-2.6	-3.5	-4.8	3.9%
Total Net Imports	13.1	14.6	16.4	22.6	25.7	27.6	29.9	3.8%
Consumption								
Petroleum Products	34.2	34.1	35.0	38.4	39.9	41.3	44.1	1.2%
Natural Gas	18.6	18.8	18.8	20.9	22.9	23.2	22.5	0.9%
Coal	18.8	19.0	19.1	20.8	22.5	25.5	29.1	2.0%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy/Other ^c	6.1	6.6	6.9	7.7	8.5	9.4	10.3	2.4%
Total Consumption^d	83.4	84.2	85.6	94.0	100.0	106.0	112.5	1.4%
Discrepancy ^e	-0.9	-0.4	0.1	-0.6	-0.5	0.2	0.5	
End-Use Prices (1989 dollars per million Btu)								
Residential								
Heating Oil	6.05	6.10	5.54	6.02	7.01	7.86	8.38	1.5%
Natural Gas	5.53	5.46	5.22	5.81	6.57	7.34	8.07	1.7%
Electricity	22.86	22.39	21.72	22.36	22.80	23.42	23.67	0.2%
Industrial								
Residual Fuel Oil	2.22	2.38	2.14	2.39	3.30	3.93	4.34	3.1%
Natural Gas	2.97	2.84	2.78	3.26	4.10	4.88	5.62	2.9%
Transportation								
Motor Gasoline	8.03	8.48	7.74	7.94	9.03	9.71	9.95	1.0%
Diesel Oil	6.84	6.91	6.43	6.90	7.87	8.71	9.22	1.4%
Electric Utilities								
Coal	1.54	1.46	1.47	1.59	1.67	1.76	1.85	0.8%
Heavy Oil	2.52	2.72	2.40	2.72	3.56	4.19	4.58	2.8%
Natural Gas	2.36	2.33	2.17	2.66	3.53	4.30	5.06	3.5%

^a Includes utility and nonutility generation of hydroelectric power; geothermal, wood, waste, wind, photovoltaic, and solar thermal sources for electricity generation; and renewables consumed for non-electric purposes.

^b Includes coal, net coal coke imports, and net electricity imports (fuel input equivalent).

^c Same as footnote ^a, plus net electricity imports and net coal coke imports, and minus biofuels for transportation.

^d Includes 3.1 quadrillion Btus of renewable energy in 1988 that are not reported in EIA's *Monthly Energy Review*.

^e A balancing item. Includes stock changes, unaccounted for supply, losses, and gains.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels, PC-AEO Run DACC488, 01/03/90.

Table B3. Petroleum Supply, Disposition, and Prices: LOW OIL PRICE
(Quantities in Million Barrels per Day)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Petroleum Production								
Crude Oil	8.14	7.65	7.23	5.71	4.77	4.44	4.09	-3.1%
Alaska	2.02	1.87	1.81	1.15	0.67	0.49	0.33	-7.9%
Lower 48 States	6.12	5.77	5.42	4.56	4.11	3.96	3.76	-2.2%
Natural Gas Liquids	1.62	1.60	1.62	1.77	1.92	1.93	1.87	0.6%
Other ^a	0.71	0.71	0.74	0.85	0.97	1.11	1.30	2.8%
Total Production	10.47	9.96	9.58	8.32	7.66	7.49	7.27	-1.6%
Net Imports (including SPR)								
Crude Oil	4.95	5.76	6.29	8.92	10.22	11.19	12.65	4.4%
Refined Products	1.63	1.57	1.75	2.04	2.10	2.13	2.28	1.5%
Total Net Imports	6.59	7.33	8.04	10.96	12.32	13.32	14.93	3.8%
Net Storage Withdrawals^b								
Crude Oil and Products (excl. SPR)	-0.08	-0.11	-0.01	0.02	0.06	0.03	0.04	-3.0%
SPR Fill Rate (-)	-0.05	-0.06	-0.05	-0.05	0.00	0.00	0.00	
Petroleum Product Supplied								
Motor Gasoline	7.34	7.35	7.47	7.76	8.09	8.54	9.12	1.0%
Jet Fuel	1.45	1.48	1.54	1.74	1.83	1.97	2.13	1.8%
Distillate Fuel	3.12	3.13	3.24	3.52	3.64	3.79	4.00	1.1%
Residual Fuel	1.38	1.32	1.26	1.87	1.88	1.72	1.90	1.5%
Liquefied Petroleum Gases	1.66	1.70	1.81	1.99	2.17	2.31	2.46	1.8%
Other ^c	2.34	2.30	2.39	2.51	2.57	2.66	2.78	0.8%
Total Products Supplied	17.28	17.28	17.70	19.40	20.19	20.99	22.39	1.2%
Unaccounted for ^d	0.20	0.17	0.14	0.15	0.15	0.15	0.15	
World Oil Price^e								
(1989 dollars per barrel)	15.27	17.10	14.40	14.30	19.80	23.90	25.90	2.4%
End-Use Prices (1989 dollars per gallon)								
Motor Gasoline (incl. tax)	1.00	1.06	0.97	0.99	1.13	1.21	1.24	1.0%
Propane	0.54	0.52	0.51	0.46	0.47	0.52	0.58	0.3%
Jet Fuel	0.53	0.55	0.48	0.55	0.69	0.82	0.90	2.4%
No. 2 Heating Oil	0.84	0.85	0.77	0.84	0.97	1.09	1.16	1.5%
Residual Fuel (dollars per barrel)	14.65	15.85	14.05	16.19	21.65	25.48	28.02	3.0%

^a Includes refinery processing gain, and other hydrocarbons and alcohol.

^b A negative (-) result represents an increase to inventories and a decrease to total supply.

^c Includes crude oil supplied as product, unfinished oils, and all other finished petroleum products not noted here.

^d A balancing item: unaccounted for crude oil supply.

^e Cost of imported crude oil to U.S. refiners.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-038(89/07); PC-AEO Run DACC488, 01/03/90.

Table B4. Natural Gas Supply, Disposition, and Prices: LOW OIL PRICE
(Quantities in Trillion Cubic Feet)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Natural Gas Production								
Dry Gas Production	16.99	16.84	16.84	18.32	19.79	19.97	19.36	0.6%
Supplemental Gas ^a	0.10	0.16	0.18	0.21	0.23	0.25	0.34	5.7%
Net Imports	1.22	1.26	1.43	2.07	2.68	2.95	2.95	4.1%
Net Storage Withdrawals ^b	0.06	0.04	0.01	0.00	0.00	0.00	0.00	
Consumption by Sector								
Residential	4.63	4.64	4.78	4.71	4.70	4.70	4.68	0.1%
Commercial	2.67	2.62	2.66	2.65	2.62	2.60	2.63	-0.1%
Industrial	6.38	6.64	6.54	6.93	7.02	7.05	7.17	0.5%
Electric Utilities	2.64	2.65	2.53	4.06	5.78	6.08	5.35	3.3%
Lease and Plant Fuel	1.10	1.14	1.12	1.28	1.39	1.40	1.36	1.0%
Pipeline Fuel	0.61	0.58	0.63	0.64	0.69	0.70	0.68	0.4%
Total Consumption	18.03	18.28	18.26	20.28	22.20	22.52	21.87	0.9%
Unaccounted for ^c	0.34	0.03	0.20	0.32	0.49	0.65	0.77	
Average Wellhead Price (1989 dollars per 1,000 cubic feet)	1.76	1.71	1.61	2.14	3.03	3.83	4.59	4.5%
End-Use Prices (1989 dollars per 1,000 cubic feet)								
Residential	5.70	5.63	5.38	5.99	6.77	7.56	8.32	1.7%
Commercial	4.83	4.75	4.63	5.15	5.96	6.76	7.52	2.0%
Industrial	3.06	2.93	2.87	3.36	4.23	5.03	5.80	2.9%
Electric Utilities	2.43	2.40	2.24	2.74	3.64	4.44	5.22	3.5%
Average to All Sectors ^d	4.00	3.89	3.78	4.16	4.88	5.66	6.47	2.2%

^a Includes synthetic natural gas (results from the manufacture, conversion, or reforming of petroleum and coal hydrocarbons), and propane-air mixtures.

^b Includes net withdrawals of dry natural gas from underground storage and liquefied natural gas. A negative (-) result represents an increase to inventories and a decrease to total supply. A positive result represents a withdrawal from inventories and an increase to total supply.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Weighted average price. Weights used are consumption values by sector, excluding lease and plant fuel and pipeline use.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Natural Gas Monthly*, DOE/EIA-0130(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); PC-AEO Run DACC488, 01/03/90.

Table B5. Coal Supply, Disposition, and Prices: LOW OIL PRICE
(Quantities in Million Short Tons)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Coal Production ^a	950	975	994	1,090	1,203	1,393	1,620	2.5%
Net Imports (- indicates exports)	-93	-95	-92	-100	-126	-162	-217	3.9%
Imports	2	2	2	5	8	10	12	8.2%
Exports	95	97	95	105	133	172	229	4.1%
Net Storage Withdrawals ^b	25	11	-2	-2	-4	-6	-7	
Consumption by Sector								
Residential/Commercial	7	7	6	6	5	5	4	-2.6%
Industrial								
Coke Plants	42	42	42	43	40	37	34	-0.9%
Other Industrial	76	77	78	81	84	92	113	1.8%
Electric Utilities	758	760	774	858	944	1091	1244	2.3%
Total Consumption	883	886	900	988	1,073	1,225	1,396	2.1%
Discrepancy ^c	-1	5	0	0	0	0	0	
Average Minemouth Price (1989 dollars per short ton) ^d	23.02	22.85	22.89	23.86	25.23	26.96	28.66	1.0%
End-Use Prices (1989 dollars per short ton)								
Residential/Commercial	49.57	48.76	48.65	50.77	53.20	55.84	58.20	0.7%
Coke Plants	49.74	49.32	49.26	51.06	53.65	56.46	59.14	0.8%
Other Industrial	34.86	34.39	34.40	35.71	37.35	39.21	40.92	0.7%
Electric Utilities	31.98	30.55	30.15	32.99	34.47	36.31	38.00	0.8%
Average to All Sectors ^e	33.22	31.92	31.53	34.11	35.49	37.21	38.81	0.7%

^a Includes anthracite, bituminous coal, and lignite.

^b From all stocks held by industrial plants, coke plants, electric utilities, and producers/distributors. A negative (-) result represents an increase to inventories. A positive result represents a withdrawal from inventories.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Free-on-board price.

^e Weighted average prices. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Quarterly Coal Report*, DOE/EIA-0121(89/2Q); *Coal Production 1988*, DOE/EIA-0118(88); PC-AEO Run DACC488, 01/03/90.

Table B6. Electricity Supply, Disposition, and Prices: LOW OIL PRICE
(Generation in Billion Kilowatthours)

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Electric Utilities							
Generation by Fuel Type							
Coal	1,538	1,537	1,596	1,716	1,881	2,192	2,587 2.4%
Petroleum	149	152	138	262	271	233	263 2.6%
Natural Gas	253	254	255	375	562	609	564 3.7%
Nuclear Power	527	521	550	558	572	592	595 0.6%
Pumped/Other Storage ^a	-9	-9	-9	-10	-10	-11	-12 1.3%
Hydropower/Other ^b	244	291	315	320	322	336	351 1.7%
Total Generation^c	2,702	2,747	2,845	3,220	3,597	3,952	4,348 2.2%
Net Imports	32	26	27	46	60	64	68 3.5%
Nonutility Purchases	69	74	88	139	204	271	334 7.4%
Electricity Sales by Sector							
Residential	895	891	932	1,054	1,163	1,259	1,351 1.9%
Commercial/Other ^d	785	819	860	991	1,124	1,265	1,409 2.7%
Industrial	900	906	933	1,104	1,266	1,415	1,603 2.7%
Total Electricity Sales^e	2,580	2,616	2,725	3,149	3,554	3,938	4,364 2.4%
Nonutilities							
Generation by Fuel Type							
Coal	28	31	34	45	57	91	126 7.1%
Petroleum	4	5	5	7	8	10	12 4.8%
Natural Gas	76	84	98	122	148	176	204 4.6%
Other Fossil ^f	12	12	12	13	13	14	15 1.0%
Pumped/Other Storage ^g	0	0	0	0	0	-1	-2
Renewable Sources ^h	59	60	61	90	123	156	189 5.5%
Total Generationⁱ	178	192	211	278	351	446	544 5.2%
Sales to Utilities	69	74	88	139	204	271	334 7.4%
Generation for Own Use	109	118	123	139	147	175	210 3.0%
End-Use Prices (1989 cents per kilowatthour)							
Residential	7.80	7.64	7.41	7.63	7.78	7.99	8.07 0.2%
Commercial	7.26	7.09	6.88	7.07	7.22	7.43	7.52 0.5%
Industrial	4.91	4.80	4.65	4.69	4.84	5.05	5.13 0.2%
Average to All Sectors^j	6.62	6.48	6.30	6.42	6.55	6.75	6.81 0.1%

^a Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^b "Other" includes geothermal, petroleum coke, biomass, wood, waste, solar, and wind.

^c Includes transmission and distribution losses.

^d "Other" includes sales of electricity to Government, railways, and street lighting authorities.

^e Total is lower by 171 billion kilowatthours in 2010 because of demand side management programs.

^f Includes petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, non-fossil waste, solar, and wind.

^h Weighted average price, including transportation. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run DACC488, 01/03/00.

Table B7. Electricity Generating Capability: LOW OIL PRICE
(Million Kilowatts)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Electric Utility Capability								
Net Summer Capability *								
Coal Steam	294.6	296.6	297.0	300.3	321.2	370.1	436.2	1.8%
Other Fossil Steam	144.6	144.3	144.2	137.0	130.5	123.8	120.1	-0.8%
Combined Cycle †	4.9	5.0	5.1	12.1	37.4	51.5	66.2	12.5%
Turbine/Diesel	44.5	45.9	46.1	62.2	76.5	84.6	91.4	3.3%
Nuclear	94.7	97.0	99.3	102.8	103.8	103.8	99.7	0.2%
Pumped/Other Storage ‡	17.0	17.0	17.0	19.5	19.5	21.0	22.5	1.3%
Hydroelectric/Other §	77.6	77.7	77.9	79.1	80.0	82.1	84.6	0.4%
Total Utility Capability	677.9	683.4	686.6	713.0	768.9	837.0	920.6	1.4%
Cumulative Planned Additions †								
Coal Steam	0.0	2.0	3.0	10.5	15.9	16.9	17.2	
Other Fossil Steam	0.0	0.0	0.0	0.5	0.6	0.6	0.6	
Combined Cycle ‡	0.0	0.0	0.1	2.5	3.0	3.0	3.0	
Turbine/Diesel	0.0	1.5	1.7	4.3	8.9	9.1	9.1	
Nuclear	0.0	3.4	5.7	9.2	10.4	10.4	11.6	
Pumped/Other Storage §	0.0	0.0	0.0	2.5	2.5	2.5	2.5	
Hydroelectric/Other ¶	0.0	0.2	0.4	1.7	2.2	2.2	2.2	
Total Planned Additions	0.0	7.1	11.0	31.2	43.5	44.7	46.1	
Cumulative Unplanned Additions †								
Coal Steam	0.0	0.0	0.0	0.0	21.6	72.9	142.4	
Combined Cycle ‡	0.0	0.0	0.0	4.6	29.4	43.6	58.3	
Turbine/Diesel	0.0	0.0	0.0	13.7	23.8	33.0	39.8	
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Pumped/Other Storage §	0.0	0.0	0.0	0.0	0.0	1.5	3.0	
Hydroelectric/Other ¶	0.0	0.0	0.0	0.0	0.3	4.0	7.9	
Total Unplanned Additions	0.0	0.0	0.0	18.3	75.1	155.1	251.4	
Cumulative Retirements †	0.0	1.5	2.3	14.4	27.5	40.6	54.7	
Nonutility Capability								
Coal	5.4	6.0	6.8	9.2	11.8	18.9	26.4	7.5%
Natural Gas	12.2	13.9	17.0	21.5	26.3	31.5	36.7	5.1%
Other Fossil	4.0	4.2	4.5	5.2	6.0	7.2	8.2	3.3%
Renewable Sources/Other ¶	9.8	10.0	10.2	16.4	22.4	30.8	39.2	6.5%
Total Nonutility Capability	31.5	34.1	38.5	52.4	66.5	88.4	110.5	5.9%

* The steady hourly output that generating equipment may supply to system load during summer peak demand.

† Includes natural gas, oil, and dual-fired oil/natural gas combined cycle capability.

‡ Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

§ Includes geothermal, wood, waste, solar, and wind.

¶ Cumulative additions from December 31, 1988.

† Includes petroleum, petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

‡ Includes hydroelectric, biomass, geothermal, wood, nonfossil waste, solar and wind, and pumped/other storage.

Sources: Energy Information Administration, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run, DACC488, 01/03/90.

Table B8. Residential Consumption and Price of Energy by Fuel: LOW OIL PRICE

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Consumption (Quadrillion Btu)							
Distillate	1.08	1.02	1.03	0.86	0.77	0.71	0.68 -2.1%
Liquefied Petroleum Gas	0.43	0.44	0.47	0.36	0.29	0.25	0.21 -3.1%
Natural Gas	4.77	4.78	4.92	4.86	4.85	4.84	4.83 0.1%
Electricity	3.05	3.04	3.18	3.60	3.97	4.29	4.61 1.9%
Renewables	0.92	0.93	0.93	0.98	1.05	1.12	1.20 1.2%
Other *	0.16	0.16	0.16	0.18	0.19	0.20	0.21 1.2%
Total	10.42	10.37	10.70	10.83	11.13	11.42	11.74 0.5%
Prices (1989 dollars per million Btu)							
Distillate	6.05	6.10	5.54	6.02	7.01	7.86	8.38 1.5%
Liquefied Petroleum Gas	8.81	8.43	8.26	7.84	8.10	8.79	9.51 0.3%
Natural Gas	5.53	5.46	5.22	5.81	6.57	7.34	8.07 1.7%
Electricity	22.86	22.39	21.72	22.36	22.80	23.42	23.67 0.2%

* Includes kerosene and steam coal.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACC488, 01/03/90.

Table B9. Commercial Consumption and Price of Energy by Fuel: LOW OIL PRICE

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	0.62	0.59	0.59	0.54	0.47	0.42	0.41	-1.9%
Natural Gas	2.75	2.70	2.75	2.74	2.70	2.69	2.71	-0.1%
Electricity	2.66	2.78	2.92	3.37	3.82	4.30	4.79	2.7%
Other *	0.59	0.56	0.55	0.51	0.47	0.45	0.43	-1.4%
Total	6.63	6.63	6.82	7.15	7.46	7.85	8.33	1.0%
Prices (1989 dollars per million Btu)								
Distillate	4.73	4.77	4.33	4.80	5.76	6.60	7.11	1.9%
Natural Gas	4.69	4.61	4.49	4.99	5.78	6.55	7.29	2.0%
Electricity	21.26	20.78	20.16	20.71	21.16	21.79	22.03	0.2%

* Includes kerosene, motor gasoline, residual fuel, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACC488, 01/03/90.

Table B10. Transportation Consumption and Price of Energy by Fuel: LOW OIL PRICE

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	3.53	3.63	3.86	4.32	4.66	5.03	5.46	2.0%
Jet Fuel	2.98	3.04	3.16	3.58	3.76	4.05	4.37	1.8%
Motor Gasoline	13.78	13.77	13.99	14.51	15.11	15.93	17.01	1.0%
Residual Fuel	0.80	0.72	0.71	0.80	0.88	0.97	1.06	1.3%
Other *	0.92	0.89	0.95	0.98	1.06	1.09	1.09	0.8%
Total	22.02	22.05	22.67	24.19	25.47	27.07	28.99	1.3%
Prices (1989 dollars per million Btu)								
Distillate	6.84	6.91	6.43	6.90	7.87	8.71	9.22	1.4%
Jet Fuel	3.96	4.14	3.56	4.09	5.18	6.13	6.71	2.4%
Motor Gasoline	8.03	8.48	7.74	7.94	9.03	9.71	9.95	1.0%
Residual Fuel	2.10	2.26	2.02	2.28	3.19	3.81	4.23	3.2%

* Includes kerosene, electricity, liquefied petroleum gas, lubricants, waxes, natural gas, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10);

State Energy Price and Expenditure Report 1985, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACC488, 01/03/90.

Table B11. Industrial Consumption and Price of Energy by Fuel: LOW OIL PRICE

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	1.32	1.29	1.30	1.54	1.64	1.68	1.78	1.4%
Liquefied Petroleum Gas	1.66	1.70	1.81	2.17	2.49	2.72	2.96	2.7%
Petrochemical Feedstocks	0.94	0.94	0.99	1.17	1.30	1.44	1.63	2.5%
Residual Fuel	0.67	0.60	0.59	0.64	0.59	0.58	0.60	-0.5%
Natural Gas	7.71	8.03	7.90	8.47	8.66	8.71	8.79	0.6%
Metallurgical Coal	1.08	1.04	1.13	1.16	1.07	0.99	0.91	-0.8%
Steam Coal	1.69	1.69	1.73	1.77	1.82	1.99	2.45	1.7%
Electricity	3.07	3.09	3.18	3.77	4.32	4.83	5.47	2.7%
Renewables	2.43	2.45	2.46	2.94	3.45	3.95	4.44	2.8%
Other *	4.01	3.98	4.16	4.24	4.21	4.23	4.28	0.3%
Total	24.57	24.80	25.24	27.87	29.55	31.11	33.30	1.4%
Prices (1989 dollars per million Btu)								
Distillate	4.36	4.39	3.99	4.46	5.43	6.28	6.79	2.0%
Liquefied Petroleum Gas	5.43	5.19	5.09	4.76	5.02	5.69	6.39	0.7%
Residual Fuel	2.22	2.38	2.14	2.39	3.30	3.93	4.34	3.1%
Natural Gas	2.97	2.84	2.78	3.26	4.10	4.88	5.62	2.9%
Metallurgical Coal	1.85	1.84	1.84	1.91	2.00	2.11	2.21	0.8%
Steam Coal	1.56	1.55	1.55	1.63	1.71	1.81	1.89	0.9%
Hydroelectric Power	12.83	12.83	12.83	12.83	12.83	12.83	12.83	0.0%

* Includes kerosene, liquefied petroleum gas, lubricants, waxes, motor gasoline, and hydropower.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-G376(85); values for 1987 are estimates. PC-AEO Run DACC488, 01/03/90.

Appendix C

High Oil Price Case Forecasts

- **Resource Prices, Economic Growth, and Energy Efficiency**
- **Total Energy Supply, Disposition, and Prices**
- **Petroleum Supply, Disposition, and Prices**
- **Natural Gas Supply, Disposition, and Prices**
- **Coal Supply, Disposition, and Prices**
- **Electricity Supply, Disposition, and Prices**
- **Electricity Generating Capability**
- **Residential Consumption and Price of Energy by Fuel**
- **Commercial Consumption and Price of Energy by Fuel**
- **Transportation Consumption and Price of Energy by Fuel**
- **Industrial Consumption and Price of Energy by Fuel**

Table C1. Resource Prices, Economic Growth, and Energy Efficiency: HIGH OIL PRICE

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Prices								
World Oil Price ^a (1989 dollars per barrel)	15.27	18.40	19.20	25.90	33.90	41.90	47.40	5.3%
Domestic Natural Gas Wellhead (1989 dollars per 1,000 cubic feet)	1.76	1.82	1.95	2.20	3.11	4.18	5.51	-5.3%
Domestic Coal Minemouth (1989 dollars per short ton)	23.02	23.24	23.10	23.31	24.51	26.40	28.33	0.9%
Economic Indicators ^b								
Real Gross National Product (billion 1982 dollars)	4,024	4,139	4,214	4,699	5,369	5,970	6,721	2.4%
Percentage Change from Prior Year	4.4%	2.9%	1.8%	3.9%	1.6%	2.6%	2.0%	
GNP Implicit Price Deflator (index 1982=1.000)	1.213	1.265	1.317	1.644	2.084	2.651	3.382	4.8%
Percentage Change from Prior Year	3.3%	4.3%	4.1%	4.1%	5.4%	4.7%	5.2%	
Real Disposable Personal Income (billion 1982 dollars)	2,793	2,902	2,935	3,178	3,558	3,887	4,324	2.0%
Percentage Change from Prior Year	4.3%	3.9%	1.1%	2.7%	1.7%	2.1%	1.9%	
Index of Manufacturing Production (index 1982=1.000)	1.219	1.244	1.257	1.437	1.709	1.905	2.200	2.7%
Percentage Change from Prior Year	5.0%	2.0%	1.1%	4.7%	2.2%	2.8%	2.8%	
Energy Efficiency (thousand Btu per 1982 dollar of GNP)								
Oil & Gas Use	13.12	12.80	12.67	11.79	11.12	10.04	9.01	-1.7%
Electricity Use	2.19	2.15	2.15	2.19	2.18	2.17	2.13	-0.1%
Total Energy Use	20.72	20.34	20.17	19.10	17.92	16.87	15.74	-1.2%

^a Cost of imported crude oil to U.S. refiners.

^b Seasonally adjusted at annual rates.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); U.S. Department of Commerce (DoC), Bureau of Economic Analysis, *Survey of Current Business*, July 1989; DoC, Office of Business Analysis; PC-AEO Run DACA287, 01/03/90.

Table C2. Total Energy Supply, Disposition, and Prices: HIGH OIL PRICE

Supply and Disposition	1988	1989	1990	1995	2000	2005	2010	Annual Percent Growth 1988-2010
Energy Summary (Quadrillion Btu)								
Primary Production								
Petroleum	19.5	18.5	18.2	17.3	16.9	15.8	14.5	-1.3%
Natural Gas	17.5	17.5	18.1	19.2	21.7	21.2	20.6	0.7%
Coal	20.7	21.2	21.4	23.4	25.4	29.7	34.7	2.4%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	-0.6%
Renewable Energy ^a	6.0	6.5	6.8	7.7	8.3	9.2	10.1	2.4%
Total Production	69.4	69.3	70.5	73.5	78.5	82.4	86.5	1.0%
Net Imports								
Petroleum (including SPR)	13.9	15.0	15.1	16.7	18.2	19.8	22.3	2.2%
Natural Gas	1.2	1.3	1.4	2.1	2.7	2.9	2.9	4.1%
Coal/Other (- indicates export) ^b	-2.1	-2.2	-2.1	-2.1	-2.6	-3.5	-4.9	4.0%
Total Net Imports	13.1	14.0	14.5	16.6	18.2	19.2	20.3	2.0%
Consumption								
Petroleum Products	34.2	34.0	33.8	34.3	35.6	36.3	37.6	0.4%
Natural Gas	18.6	19.0	19.6	21.1	24.1	23.7	23.0	1.0%
Coal	18.8	19.0	18.8	20.6	21.8	25.0	28.4	1.9%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy/Other ^c	6.1	6.6	6.9	7.7	8.5	9.4	10.3	2.4%
Total Consumption ^d	83.4	84.2	85.0	89.7	96.2	100.7	105.8	1.1%
Discrepancy ^e	-0.9	-0.8	0.0	0.4	0.5	0.8	1.0	
End-Use Prices (1989 dollars per million Btu)								
Residential								
Heating Oil	6.05	6.29	6.65	7.82	9.14	10.50	11.52	3.0%
Natural Gas	5.53	5.51	5.61	6.06	7.04	8.07	9.36	2.4%
Electricity	22.86	22.43	22.64	22.36	22.94	23.58	24.13	0.2%
Industrial								
Residual Fuel Oil	2.22	2.53	2.85	4.05	5.43	6.80	7.75	5.9%
Natural Gas	2.97	2.93	3.26	3.39	4.32	5.36	6.65	3.7%
Transportation								
Motor Gasoline	8.03	8.54	8.98	9.62	11.23	12.81	13.83	2.5%
Diesel Oil	6.84	6.98	6.94	8.10	9.41	10.75	11.77	2.5%
Electric Utilities								
Coal	1.54	1.46	1.47	1.59	1.66	1.75	1.85	0.8%
Heavy Oil	2.52	2.85	3.11	4.32	5.66	7.02	7.98	5.4%
Natural Gas	2.36	2.39	2.63	2.89	3.76	4.77	6.07	4.4%

^a Includes utility and nonutility generation of hydroelectric power; geothermal, wood, waste, wind, photovoltaic, and solar thermal sources for electricity generation; and renewables consumed for non-electric purposes.

^b Includes coal, net coal coke imports, and net electricity imports (fuel input equivalent).

^c Same as footnote a, plus net electricity imports and net coal coke imports, and minus biofuels for transportation.

^d Includes 3.1 quadrillion Btus of renewable energy in 1988 that are not reported in EIA's *Monthly Energy Review*.

^e A balancing item. Includes stock changes, unaccounted for supply, losses, and gains.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run DACA287, 01/03/90.

Table C3. Petroleum Supply, Disposition, and Prices: HIGH OIL PRICE
(Quantities in Million Barrels per Day)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Petroleum Production								
Crude Oil	8.14	7.69	7.53	7.05	6.67	6.22	5.62	-1.7%
Alaska	2.02	1.87	1.85	1.42	1.11	0.85	0.75	-4.4%
Lower 48 States	6.12	5.81	5.68	5.63	5.56	5.37	4.87	-1.0%
Natural Gas Liquids	1.62	1.60	1.61	1.71	1.97	1.91	1.86	0.6%
Other *	0.71	0.70	0.71	0.75	0.86	0.96	1.10	2.0%
Total Production	10.47	9.99	9.86	9.51	9.49	9.10	8.58	-0.9%
Net Imports (including SPR)								
Crude Oil	4.95	5.62	5.56	6.09	6.69	7.43	8.59	2.5%
Refined Products	1.63	1.44	1.59	1.67	1.73	1.75	1.79	0.4%
Total Net Imports	6.59	7.07	7.15	7.76	8.42	9.18	10.38	2.1%
Net Storage Withdrawals *								
Crude Oil and Products (excl. SPR)	0.08	0.05	0.01	-0.03	0.00	-0.03	-0.02	
SPR Fill Rate (-)	-0.05	-0.06	-0.05	-0.05	0.00	0.00	0.00	
Petroleum Product Supplied								
Motor Gasoline	7.34	7.34	7.35	7.29	7.50	7.63	7.90	0.3%
Jet Fuel	1.45	1.47	1.46	1.53	1.66	1.73	1.85	1.1%
Distillate Fuel	3.12	3.11	3.10	3.08	3.21	3.29	3.45	0.5%
Residual Fuel	1.38	1.30	1.12	1.34	1.32	1.27	1.20	-0.6%
Liquefied Petroleum Gases	1.66	1.69	1.72	1.72	1.89	1.95	2.06	1.0%
Other *	2.34	2.30	2.35	2.39	2.48	2.54	2.63	0.5%
Total Products Supplied	17.28	17.21	17.11	17.35	18.06	18.40	19.09	0.5%
Unaccounted for ^b	0.20	0.17	0.14	0.15	0.15	0.15	0.15	
World Oil Price *								
(1989 dollars per barrel)	15.27	18.40	19.20	25.90	33.90	41.90	47.40	5.3%
End-Use Prices (1989 dollars per gallon)								
Motor Gasoline (incl. tax)	1.00	1.07	1.12	1.20	1.40	1.60	1.73	2.5%
Propane	0.54	0.53	0.59	0.62	0.64	0.78	0.91	2.4%
Jet Fuel	0.53	0.57	0.61	0.78	0.98	1.18	1.34	4.3%
No. 2 Heating Oil	0.84	0.87	0.92	1.08	1.27	1.46	1.60	3.0%
Residual Fuel (dollars per barrel)	14.65	16.71	18.47	26.22	34.70	43.22	49.09	5.7%

* Includes refinery processing gain, and other hydrocarbons and alcohol.

A negative (-) result represents an increase to inventories and a decrease to total supply.

Includes crude oil supplied as product, unfinished oils, and all other finished petroleum products not noted here.

A balancing item: unaccounted for crude oil supply.

Cost of imported crude oil to U.S. refiners.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); PC-AEO Run DACA287, 01/03/90.

Table C4. Natural Gas Supply, Disposition, and Prices: HIGH OIL PRICE
(Quantities in Trillion Cubic Feet)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Natural Gas Production								
Dry Gas Production	16.99	16.98	17.60	18.58	21.09	20.56	20.01	0.7%
Supplemental Gas *	0.10	0.16	0.18	0.10	0.10	0.14	0.16	2.1%
Net Imports	1.22	1.26	1.43	2.07	2.68	2.95	2.95	4.1%
Net Storage Withdrawals *	0.06	0.04	0.01	0.00	0.00	0.00	0.00	
Consumption by Sector								
Residential	4.63	4.64	4.78	4.68	4.68	4.64	4.59	0.0%
Commercial	2.67	2.62	2.66	2.67	2.61	2.56	2.53	-0.2%
Industrial	6.38	6.74	7.03	7.44	7.76	7.57	7.50	0.7%
Electric Utilities	2.64	2.66	2.66	3.68	6.08	6.04	5.59	3.5%
Lease and Plant Fuel	1.10	1.16	1.21	1.30	1.48	1.44	1.40	1.1%
Pipeline Fuel	0.61	0.59	0.68	0.65	0.74	0.72	0.70	0.6%
Total Consumption	18.03	18.41	19.01	20.42	23.34	22.97	22.32	1.0%
Unaccounted for †	0.34	0.03	0.20	0.33	0.53	0.67	0.80	
Average Wellhead Price (1989 dollars per 1,000 cubic feet)	1.76	1.82	1.95	2.20	3.11	4.18	5.51	5.3%
End-Use Prices (1989 dollars per 1,000 cubic feet)								
Residential	5.70	5.68	5.79	6.24	7.26	8.32	9.65	2.4%
Commercial	4.83	4.81	5.07	5.36	6.35	7.42	8.75	2.7%
Industrial	3.06	3.02	3.36	3.49	4.45	5.53	6.86	3.7%
Electric Utilities	2.43	2.47	2.71	2.98	3.88	4.92	6.25	4.4%
Average to All Sectors ‡	4.00	3.95	4.20	4.36	5.14	6.21	7.56	2.9%

* Includes synthetic natural gas (results from the manufacture, conversion, or reforming of petroleum and coal hydrocarbons), and propane-air mixtures.

† Includes net withdrawals of dry natural gas from underground storage and liquefied natural gas. A negative (-) result represents an increase to inventories and a decrease to total supply. A positive result represents a withdrawal from inventories and an increase to total supply.

‡ A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

§ Weighted average price. Weights used are consumption values by sector, excluding lease and plant fuel and pipeline use.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Natural Gas Monthly*, DOE/EIA-0130(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); PC-AEO Run DACA287, 01/03/90.

Table C5. Coal Supply, Disposition, and Prices: HIGH OIL PRICE
(Quantities in Million Short Tons)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Coal Production ^a	950	969	982	1,078	1,171	1,368	1,595	2.4%
Net Imports (- indicates exports)	-93	-95	-92	-99	-127	-165	-221	4.0%
Imports	2	2	2	5	8	10	12	8.2%
Exports	95	97	95	104	134	175	233	4.2%
Net Storage Withdrawals ^b	25	11	-2	-3	-3	-7	-8	
Consumption by Sector								
Residential/Commercial		6	6	6	5	5	4	-2.6%
Industrial								
Coke Plants	42	41	40	41	38	35	32	-1.2%
Other Industrial	76	76	76	78	82	102	112	1.7%
Electric Utilities	758	757	766	850	916	1055	1218	2.2%
Total Consumption	883	880	888	975	1,042	1,196	1,366	2.0%
Discrepancy ^c	-1	5	0	0	0	0	0	
Average Minemouth Price (1989 dollars per short ton) ^d	23.02	23.24	23.10	23.31	24.51	26.40	28.33	0.9%
End-Use Prices (1989 dollars per short ton)								
Residential/Commercial	49.57	48.76	48.65	50.90	52.98	55.85	58.61	0.8%
Coke Plants	49.74	49.32	49.26	51.04	53.33	56.36	59.49	0.8%
Other Industrial	34.86	34.39	34.39	35.46	36.85	39.07	40.98	0.7%
Electric Utilities	31.98	30.76	31.76	32.85	34.16	36.03	38.03	0.8%
Average to All Sectors ^e	33.22	32.56	32.88	33.94	35.17	36.96	38.84	0.7%

^a Includes anthracite, bituminous coal, and lignite.

^b From all stocks held by industrial plants, coke plants, electric utilities, and producers/distributors. A negative (-) result represents an increase to inventories. A positive result represents a withdrawal from inventories.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Free-on-board price.

^e Weighted average prices. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Quarterly Coal Report*, DOE/EIA-0121(89/2Q); *Coal Production 1988*, DOE/EIA-0118(88); PC-AEO Run DACA287, 01/03/90.

Table C6. Electricity Supply, Disposition, and Prices: HIGH OIL PRICE
(Generation in Billion Kilowatthours)

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Electric Utilities							
Generation by Fuel Type							
Coal	1,538	1,527	1,525	1,700	1,826	2,118	2,531 2.3%
Petroleum	149	150	123	167	169	159	137 -0.4%
Natural Gas	253	253	242	341	582	592	567 3.7%
Nuclear Power	527	521	550	558	572	592	595 0.6%
Pumped/Other Storage ^a	-9	-9	-9	-10	-10	-11	-12 1.3%
Hydropower/Other ^b	244	291	315	320	322	336	351 1.7%
Total Generation ^c	2,702	2,734	2,746	3,076	3,461	3,786	4,170 2.0%
Net Imports	32	26	27	46	60	64	68 3.5%
Nonutility Purchases	69	74	88	139	204	271	334 7.4%
Electricity Sales by Sector							
Residential	895	890	923	1,036	1,145	1,244	1,343 1.9%
Commercial/Other ^d	785	817	846	981	1,115	1,259	1,407 2.7%
Industrial	900	899	884	993	1,170	1,286	1,453 2.2%
Total Electricity Sales ^e	2,580	2,607	2,653	3,010	3,430	3,789	4,202 2.2%
Nonutilities							
Generation by Fuel Type							
Coal	28	31	34	45	57	91	126 7.1%
Petroleum	4	5	5	7	8	10	12 4.8%
Natural Gas	76	84	98	122	148	176	204 4.6%
Other Fossil ^f	12	12	12	13	13	14	15 1.0%
Pumped/Other Storage ^a	0	0	0	0	0	-1	-2
Renewable Sources ^g	59	60	61	90	123	156	189 5.5%
Total Generation ^c	178	192	211	278	351	446	544 5.2%
Sales to Utilities	69	74	88	139	204	271	334 7.4%
Generation for Own Use	109	118	123	139	147	175	210 3.0%
End-Use Prices (1989 cents per kilowatthour)							
Residential	7.80	7.65	7.72	7.63	7.83	8.04	8.23 0.2%
Commercial	7.26	7.10	7.17	7.06	7.27	7.48	7.67 0.3%
Industrial	4.91	4.80	4.85	4.69	4.88	5.10	5.30 0.3%
Average to All Sectors ^h	6.62	6.50	6.59	6.47	6.64	6.86	7.03 0.3%

^a Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^b "Other" includes geothermal, petroleum coke, biomass, wood, waste, solar, and wind.

^c Includes transmission and distribution losses.

^d "Other" includes sales of electricity to Government, railways, and street lighting authorities.

^e Total is lower by 171 billion kilowatthours in 2010 because of demand side management programs.

^f Includes petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, non-fossil waste, solar, and wind.

^h Weighted average price, including transportation. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run, DACA287, 01/03/90.

Table C7. Electricity Generating Capability: HIGH OIL PRICE
(Million Kilowatts)

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	1988-2010
Electric Utility Capability							
Net Summer Capability *							
Coal Steam	294.6	296.6	297.0	300.3	312.3	358.7	428.1 1.7%
Other Fossil Steam	144.6	144.3	144.2	137.0	130.5	123.8	120.1 -0.8%
Combined Cycle	4.9	5.0	5.1	9.9	38.1	40.6	49.3 11.0%
Turbine/Diesel	44.5	45.9	46.1	51.7	67.1	73.0	79.4 2.7%
Nuclear	94.7	97.0	99.3	102.8	103.8	103.8	99.7 0.2%
Pumped/Other Storage	17.0	17.0	17.0	19.5	19.5	21.0	22.5 1.3%
Hydroelectric/Other	77.6	77.7	77.9	79.1	80.0	82.1	84.6 0.4%
Total Utility Capability	677.9	683.4	686.6	700.4	751.2	803.1	883.6 1.2%
Cumulative Planned Additions							
Coal Steam	0.0	2.0	3.0	10.5	15.9	16.9	17.2
Other Fossil Steam	0.0	0.0	0.0	0.5	0.6	0.6	0.6
Combined Cycle	0.0	0.0	0.1	2.5	3.0	3.0	3.0
Turbine/Diesel	0.0	1.5	1.7	4.3	8.9	9.1	9.1
Nuclear	0.0	3.4	5.7	9.2	10.4	10.4	11.6
Pumped/Other Storage	0.0	0.0	0.0	2.5	2.5	2.5	2.5
Hydroelectric/Other	0.0	0.2	0.4	1.7	2.2	2.2	2.2
Total Planned Additions	0.0	7.1	11.0	31.2	43.5	44.7	46.1
Cumulative Unplanned Additions							
Coal Steam	0.0	0.0	0.0	0.0	12.6	61.5	134.3
Combined Cycle	0.0	0.0	0.0	2.5	30.1	32.7	41.3
Turbine/Diesel	0.0	0.0	0.0	3.3	14.4	21.4	27.8
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumped/Other Storage	0.0	0.0	0.0	0.0	0.0	1.5	3.0
Hydroelectric/Other	0.0	0.0	0.0	0.0	0.3	4.0	7.9
Total Unplanned Additions	0.0	0.0	0.0	5.8	57.5	121.1	214.3
Cumulative Retirements	0.0	1.5	2.3	14.4	27.5	40.6	54.7
Nonutility Capability							
Coal	5.4	6.0	6.8	9.2	11.8	18.9	26.4 7.5%
Natural Gas	12.2	13.9	17.0	21.5	26.3	31.5	36.7 5.1%
Other Fossil	4.0	4.2	4.5	5.2	6.0	7.2	8.2 3.3%
Renewable Sources/Other	9.8	10.0	10.2	16.4	22.4	30.8	39.2 6.5%
Total Nonutility Capability	31.5	34.1	38.5	52.4	66.5	88.4	110.5 5.9%

* The steady hourly output that generating equipment may supply to system load during summer peak demand.

† Includes natural gas, oil, and dual-fired oil/natural gas combined cycle capability.

‡ Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

§ Includes geothermal, wood, waste, solar, and wind.

|| Cumulative additions from December 31, 1988.

¶ Includes petroleum, petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

* Includes hydroelectric, biomass, geothermal, wood, nonfossil waste, solar and wind, and pumped/other storage.

Source: Energy Information Administration, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run
DACA287, 01/03/90

Table C8. Residential Consumption and Price of Energy by Fuel: HIGH OIL PRICE

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	1.08	1.02	1.03	0.80	0.68	0.61	0.56	-2.9%
Liquefied Petroleum Gas	0.43	0.44	0.45	0.34	0.28	0.23	0.20	-3.4%
Natural Gas	4.77	4.78	4.92	4.83	4.83	4.79	4.73	0.0%
Electricity	3.05	3.04	3.15	3.53	3.91	4.25	4.58	1.9%
Renewables	0.92	0.93	0.93	0.98	1.05	1.12	1.20	1.2%
Other *	0.16	0.16	0.16	0.18	0.19	0.20	0.21	1.2%
Total	10.42	10.37	10.64	10.66	10.93	11.20	11.48	0.4%
Prices (1989 dollars per million Btu)								
Distillate	6.05	6.29	6.65	7.82	9.14	10.50	11.52	3.0%
Liquefied Petroleum Gas	8.81	8.69	9.66	10.11	10.46	12.12	13.71	2.0%
Natural Gas	5.53	5.51	5.61	6.06	7.04	8.07	9.36	2.4%
Electricity	22.86	22.47	22.64	22.36	22.94	23.58	24.13	0.2%

* Includes kerosene and steam coal.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10);

State Energy Price and Expenditure Report 1985, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACA287, 01/03/90.

Table C9. Commercial Consumption and Price of Energy by Fuel: HIGH OIL PRICE

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Consumption (Quadrillion Btu)								
Distillate	0.62	0.59	0.59	0.51	0.44	0.38	0.36	-2.4%
Natural Gas	2.75	2.70	2.75	2.75	2.69	2.64	2.61	-0.2%
Electricity	2.66	2.77	2.87	3.33	3.79	4.28	4.78	2.7%
Other *	0.59	0.56	0.52	0.48	0.45	0.42	0.40	-1.7%
Total	6.63	6.62	6.73	7.07	7.36	7.72	8.16	0.9%
Prices (1989 dollars per million Btu)								
Distillate	4.73	4.92	5.20	6.35	7.64	8.97	9.98	3.5%
Natural Gas	4.69	4.66	4.92	5.20	6.16	7.20	8.49	2.7%
Electricity	21.26	20.82	21.01	20.70	21.30	21.93	22.49	0.3%

* Includes kerosene, motor gasoline, residual fuel, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACA287, 01/03/90.

Table C10. Transportation Consumption and Price of Energy by Fuel: HIGH OIL PRICE

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	3.53	3.60	3.65	3.91	4.28	4.55	4.90	1.5%
Jet Fuel	2.98	3.03	2.99	3.14	3.40	3.55	3.80	1.1%
Motor Gasoline	13.78	13.75	13.78	13.63	14.00	14.21	14.69	0.3%
Residual Fuel	0.80	0.71	0.64	0.70	0.78	0.85	0.93	0.7%
Other *	0.92	0.90	0.99	0.99	1.11	1.13	1.14	1.0%
Total	22.02	21.98	22.06	22.36	23.57	24.28	25.46	0.7%
Prices (1989 dollars per million Btu)								
Distillate	6.84	6.98	6.94	8.10	9.41	10.75	11.77	2.5%
Jet Fuel	3.96	4.28	4.53	5.83	7.31	8.82	9.97	4.3%
Motor Gasoline	8.03	8.54	8.98	9.62	11.23	12.81	13.83	2.5%
Residual Fuel	2.10	2.40	2.70	3.89	5.28	6.65	7.60	6.0%

* Includes kerosene, electricity, liquefied petroleum gas, lubricants, waxes, natural gas, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run DACA287, 01/03/90.

Table C11. Industrial Consumption and Price of Energy by Fuel: HIGH OIL PRICE

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	1.32	1.28	1.22	1.25	1.27	1.28	1.33	0.0%
Liquefied Petroleum Gas	1.66	1.69	1.72	1.83	2.13	2.25	2.44	1.8%
Petrochemical Feedstocks	0.94	0.93	0.93	1.05	1.20	1.31	1.45	2.0%
Residual Fuel	0.67	0.59	0.53	0.45	0.43	0.41	0.43	-2.0%
Natural Gas	7.71	8.14	8.49	9.01	9.52	9.29	9.18	0.8%
Metallurgical Coal	1.08	1.04	1.07	1.10	1.02	0.94	0.87	-1.0%
Steam Coal	1.69	1.69	1.69	1.72	1.78	2.21	2.41	1.6%
Electricity	3.07	3.07	3.02	3.39	3.99	4.39	4.96	2.2%
Renewables	2.43	2.45	2.46	2.94	3.45	3.95	4.44	2.8%
Other *	4.01	3.98	4.15	4.09	4.10	4.09	4.12	0.1%
Total	24.57	24.86	25.26	26.84	28.90	30.10	31.63	1.2%
Prices (1989 dollars per million Btu)								
Distillate	4.36	4.53	4.79	5.95	7.26	8.61	9.63	3.7%
Liquefied Petroleum Gas	5.43	5.35	5.95	6.48	6.83	8.48	10.04	2.8%
Residual Fuel	2.22	2.53	2.85	4.05	5.43	6.80	7.75	5.9%
Natural Gas	2.97	2.93	3.26	3.39	4.32	5.36	6.65	3.7%
Metallurgical Coal	1.85	1.84	1.84	1.90	1.99	2.10	2.22	0.8%
Steam Coal	1.56	1.55	1.55	1.61	1.69	1.80	1.90	0.9%
Hydroelectric Power	12.83	12.83	12.83	12.83	12.83	12.83	12.83	0.0%
Electricity	14.38	14.08	14.21	13.75	14.31	14.95	15.52	0.3%

* Includes kerosene, liquefied petroleum gas, lubricants, waxes, motor gasoline, and hydropower.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10);

State Energy Price and Expenditure Report 1985, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO-Run D'ACA287.01/03/90

Appendix D

Low Growth Case Forecasts

- **Resource Prices, Economic Growth, and Energy Efficiency**
- **Total Energy Supply, Disposition, and Prices**
- **Petroleum Supply, Disposition, and Prices**
- **Natural Gas Supply, Disposition, and Prices**
- **Coal Supply, Disposition, and Prices**
- **Electricity Supply, Disposition, and Prices**
- **Electricity Generating Capability**
- **Residential Consumption and Price of Energy by Fuel**
- **Commercial Consumption and Price of Energy by Fuel**
- **Transportation Consumption and Price of Energy by Fuel**
- **Industrial Consumption and Price of Energy by Fuel**

Table D1. Resource Prices, Economic Growth, and Energy Efficiency: LOW GROWTH

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Prices								
World Oil Price ^a (1989 dollars per barrel)	15.27	17.70	16.80	20.40	27.80	32.90	36.90	4.1%
Domestic Natural Gas Wellhead (1989 dollars per 1,000 cubic feet)	1.76	1.78	1.79	1.93	2.86	3.61	4.57	4.4%
Domestic Coal Minemouth (1989 dollars per short ton)	23.02	23.15	22.78	22.67	23.90	25.11	26.58	0.7%
Economic Indicators^b								
Real Gross National Product (billion 1982 dollars)	4,024	4,123	4,127	4,585	5,088	5,654	6,297	2.1%
Percentage Change from Prior Year	4.4%	2.5%	0.1%	2.8%	1.7%	2.4%	1.9%	
GNP Implicit Price Deflator (index 1982=1,000)	1,213	1,265	1,326	1,791	2,352	3,045	3,947	5.5%
Percentage Change from Prior Year	3.3%	4.3%	4.8%	5.3%	5.7%	5.0%	5.5%	
Real Disposable Personal Income (billion 1982 dollars)	2,793	2,890	2,871	3,122	3,407	3,719	4,110	1.8%
Percentage Change from Prior Year	4.3%	3.5%	-0.7%	2.1%	1.5%	2.1%	1.8%	
Index of Manufacturing Production (index 1982=1,000)	1,219	1,233	1,199	1,382	1,576	1,752	1,975	2.2%
Percentage Change from Prior Year	5.0%	1.1%	-2.8%	3.1%	2.2%	2.4%	2.6%	
Energy Efficiency (thousand Btu per 1982 dollar of GNP)								
Oil & Gas Use	13.12	12.81	12.74	12.11	11.46	10.51	9.57	-1.4%
Electricity Use	2.19	2.16	2.19	2.24	2.27	2.24	2.21	0.0%
Total Energy Use	20.72	20.38	20.40	19.59	18.62	17.55	16.52	-1.0%

^a Cost of imported crude oil to U.S. refiners.

^b Seasonally adjusted at annual rates.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); U.S. Department of Commerce (DoC), Bureau of Economic Analysis, *Survey of Current Business*, July 1989; DoC, Office of Business Analysis; PC-AEO Run ADGQ317, 01/03/90.

Table D2. Total Energy Supply, Disposition, and Prices: LOW GROWTH

Supply and Disposition	1988	1989	1990	1995	2000	2005	2010	Annual Percent Growth 1988-2010
Energy Summary (Quadrillion Btu)								
Primary Production								
Petroleum	19.5	18.5	17.9	16.0	15.0	13.9	12.7	-1.9%
Natural Gas	17.5	17.4	17.4	18.6	20.2	20.2	19.7	0.5%
Coal	20.7	21.2	21.4	23.1	24.8	27.6	31.4	1.9%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy ^a	6.0	6.5	6.8	7.7	8.3	9.2	10.1	2.4%
Total Production	69.4	69.1	69.4	71.4	74.6	77.3	80.4	0.7%
Net Imports								
Petroleum (including SPR)	13.9	15.0	15.5	18.5	20.0	22.2	24.6	2.6%
Natural Gas	1.2	1.3	1.4	2.0	2.4	2.7	2.7	3.6%
Coal/Other (- indicates export) ^b	-2.1	-2.2	-2.1	-1.9	-2.1	-2.4	-3.0	1.7%
Total Net Imports	13.1	14.1	14.8	18.6	20.3	22.5	24.2	2.8%
Consumption								
Petroleum Products	34.2	34.0	33.8	35.1	36.0	37.0	38.4	0.5%
Natural Gas	18.6	18.8	18.8	20.4	22.3	22.4	21.8	0.7%
Coal	18.8	19.0	18.8	20.5	21.7	24.0	27.0	1.7%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy/Other ^c	6.1	6.6	6.9	7.7	8.5	9.4	10.3	2.4%
Total Consumption^d	83.4	84.0	84.2	89.8	94.8	99.2	104.0	1.0%
Discrepancy ^e	-0.9	-0.8	0.0	0.1	0.1	0.5	0.6	
End-Use Prices (1989 dollars per million Btu)								
Residential								
Heating Oil	6.05	6.20	6.07	6.91	8.07	9.05	9.82	2.2%
Natural Gas	5.53	5.49	5.38	5.70	6.60	7.33	8.25	1.8%
Electricity	22.86	22.41	22.04	21.55	21.92	22.42	22.85	0.0%
Industrial								
Residual Fuel Oil	2.22	2.46	2.48	3.15	4.42	5.28	5.95	4.6%
Natural Gas	2.97	2.89	2.98	3.05	3.99	4.71	5.60	2.9%
Transportation								
Motor Gasoline	8.03	8.51	8.33	8.23	9.79	10.73	11.45	1.6%
Diesel Oil	6.84	6.95	6.65	7.47	8.62	9.59	10.35	1.9%
Electric Utilities								
Coal	1.54	1.46	1.47	1.56	1.64	1.72	1.80	0.7%
Heavy Oil	2.52	2.78	2.73	3.43	4.65	5.50	6.19	4.2%
Natural Gas	2.36	2.36	2.38	2.60	3.46	4.18	4.95	3.4%

^a Includes utility and nonutility generation of hydroelectric power; geothermal, wood, waste, wind, photovoltaic, and solar thermal sources for electricity generation; and renewables consumed for non-electric purposes.

^b Includes coal, net coal coke imports, and net electricity imports (fuel input equivalent).

^c Same as footnote a, plus net electricity imports and net coal coke imports, and minus biofuels for transportation.

^d Includes 3.1 quadrillion Btus of renewable energy in 1988 that are not reported in EIA's *Monthly Energy Review*.

^e A balancing item. Includes stock changes, unaccounted for supply, losses, and gains.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run ADGQ317, 01/03/90.

Table D3. Petroleum Supply, Disposition, and Prices: LOW GROWTH
(Quantities in Million Barrels per Day)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Petroleum Production								
Crude Oil	8.14	7.67	7.37	6.40	5.86	5.35	4.78	-2.4%
Alaska	2.02	1.87	1.84	1.28	0.96	0.65	0.46	-6.5%
Lower 48 States	6.12	5.79	5.54	5.12	4.90	4.70	4.33	-1.6%
Natural Gas Liquids	1.62	1.60	1.61	1.74	1.89	1.89	1.84	0.6%
Other *	0.71	0.70	0.71	0.77	0.87	1.00	1.14	2.2%
Total Production	10.47	9.97	9.70	8.91	8.63	8.23	7.77	-1.3%
Net Imports (including SPR)								
Crude Oil	4.95	5.65	5.72	7.04	7.74	8.67	9.81	3.2%
Refined Products	1.63	1.44	1.59	1.71	1.75	1.79	1.83	0.5%
Total Net Imports	6.59	7.09	7.31	8.75	9.49	10.46	11.64	2.6%
Net Storage Withdrawals *								
Crude Oil and Products (excl. SPR)	0.08	0.05	0.01	-0.01	0.00	-0.03	-0.02	
SPR Fill Rate (-)	-0.05	-0.06	-0.05	-0.05	0.00	0.00	0.00	
Petroleum Product Supplied								
Motor Gasoline	7.34	7.34	7.35	7.52	7.73	7.99	8.36	0.6%
Jet Fuel	1.45	1.47	1.46	1.53	1.60	1.67	1.77	0.9%
Distillate Fuel	3.12	3.11	3.10	3.14	3.21	3.29	3.43	0.4%
Residual Fuel	1.38	1.30	1.12	1.36	1.36	1.32	1.25	-0.4%
Liquefied Petroleum Gases	1.66	1.69	1.72	1.77	1.91	2.00	2.11	1.1%
Other	2.34	2.30	2.35	2.41	2.46	2.53	2.62	0.5%
Total Products Supplied	17.28	17.21	17.11	17.74	18.27	18.81	19.54	0.6%
Unaccounted for	0.20	0.17	0.14	0.15	0.15	0.15	0.15	
World Oil Price *								
(1989 dollars per barrel)	15.27	17.70	16.80	20.40	27.80	32.90	36.90	4.1%
End-Use Prices (1989 dollars per gallon)								
Motor Gasoline (incl. tax)	1.00	1.06	1.04	1.03	1.22	1.34	1.43	1.6%
Propane	0.54	0.53	0.54	0.52	0.55	0.61	0.69	1.1%
Jet Fuel	0.53	0.56	0.54	0.66	0.84	0.98	1.10	3.4%
No. 2 Heating Oil	0.84	0.86	0.84	0.96	1.12	1.25	1.36	2.2%
Residual Fuel (dollars per barrel)	14.65	16.29	16.15	20.65	28.42	33.71	37.90	4.4%

* Includes refinery processing gain, and other hydrocarbons and alcohol.

† A negative (-) result represents an increase to inventories and a decrease to total supply.

‡ Includes crude oil supplied as product, unfinished oils, and all other finished petroleum products not noted here.

§ A balancing item: unaccounted for crude oil supply.

¶ Cost of imported crude oil to U.S. refiners.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-038(88/07); PC-AEO Run ADGQ317, 01/03/90.

Table D4. Natural Gas Supply, Disposition, and Prices: LOW GROWTH
(Quantities in Trillion Cubic Feet)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Natural Gas Production								
Dry Gas Production	16.99	16.84	16.84	18.06	19.61	19.55	19.12	0.5%
Supplemental Gas ^a	0.10	0.16	0.18	0.11	0.11	0.15	0.17	2.4%
Net Imports	1.22	1.26	1.43	1.98	2.36	2.66	2.66	3.6%
Net Storage Withdrawals ^b	0.06	0.04	0.01	0.00	0.00	0.00	0.00	
Consumption by Sector								
Residential	4.63	4.64	4.78	4.68	4.64	4.59	4.54	-0.1%
Commercial	2.67	2.62	2.66	2.67	2.60	2.58	2.57	-0.2%
Industrial	6.38	6.64	6.54	6.90	6.88	6.75	6.66	0.2%
Electric Utilities	2.64	2.65	2.53	3.68	5.42	5.75	5.42	3.3%
Lease and Plant Fuel	1.10	1.14	1.12	1.26	1.37	1.37	1.34	0.9%
Pipeline Fuel	0.61	0.58	0.63	0.63	0.69	0.68	0.67	0.4%
Total Consumption	18.03	18.28	18.26	19.82	21.60	21.73	21.19	0.7%
Unaccounted for ^c	0.34	0.03	0.20	0.32	0.49	0.64	0.76	
Average Wellhead Price (1989 dollars per 1,000 cubic feet)	1.76	1.78	1.79	1.93	2.86	3.61	4.57	4.4%
End-Use Prices (1989 dollars per 1,000 cubic feet)								
Residential	5.70	5.66	5.54	5.88	6.81	7.55	8.50	1.8%
Commercial	4.83	4.78	4.81	5.01	5.95	6.70	7.65	2.1%
Industrial	3.06	2.98	3.08	3.15	4.11	4.86	5.77	2.9%
Electric Utilities	2.43	2.44	2.45	2.68	3.56	4.31	5.11	3.4%
Average to All Sectors ^d	4.00	3.93	3.97	4.04	4.84	5.57	6.48	2.2%

^a Includes synthetic natural gas (results from the manufacture, conversion, or reforming of petroleum and coal hydrocarbons), and propane-air mixtures.

^b Includes net withdrawals of dry natural gas from underground storage and liquefied natural gas. A negative (-) result represents an increase to inventories and a decrease to total supply. A positive result represents a withdrawal from inventories and an increase to total supply.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Weighted average price. Weights used are consumption values by sector, excluding lease and plant fuel and pipeline use.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Natural Gas Monthly*, DOE/EIA-0130(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); PC-AEO Run ADGQ317, 01/03/90.

Table D5. Coal Supply, Disposition, and Prices: LOW GROWTH
(Quantities in Million Short Tons)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Coal Production ^a	950	969	982	1,066	1,148	1,276	1,452	1.9%
Net Imports (- indicates exports)	-93	-95	-92	-89	-106	-122	-149	2.2%
Imports	2	2	2	5	8	10	12	8.2%
Exports	95	97	95	94	113	132	161	2.4%
Net Storage Withdrawals ^b	25	11	-2	-3	-3	-5	-7	
Consumption by Sector								
Residential/Commercial	7	6	6	6	5	5	4	-2.6%
Industrial								
Coke Plants	42	41	40	41	38	35	32	-1.2%
Other Industrial	76	76	76	77	78	85	104	1.4%
Electric Utilities	758	757	766	850	917	1025	1156	1.9%
Total Consumption	883	880	888	974	1,039	1,149	1,296	1.8%
Discrepancy ^c	-1	5	0	0	0	0	0	
Average Minemouth Price (1989 dollars per short ton) ^d	23.02	23.15	22.78	22.67	23.90	25.11	26.58	0.7%
End-Use Prices (1989 dollars per short ton)								
Residential/Commercial	49.57	48.76	48.65	50.24	52.71	54.94	57.29	0.7%
Coke Plants	49.74	49.32	49.26	50.27	52.84	55.10	57.65	0.7%
Other Industrial	34.86	34.39	34.39	34.82	36.40	37.82	39.48	0.6%
Electric Utilities	31.98	30.76	31.54	32.34	33.82	35.35	37.09	0.7%
Average to All Sectors ^e	33.22	32.06	32.70	33.40	34.81	36.21	37.86	0.6%

^a Includes anthracite, bituminous coal, and lignite.

^b From all stocks held by industrial plants, coke plants, electric utilities, and producers/distributors. A negative (-) result represents an increase to inventories. A positive result represents a withdrawal from inventories.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Free-on-board price.

^e Weighted average prices. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Quarterly Coal Report*, DOE/EIA-0121(89/2Q); *Coal Production 1988*, DOE/EIA-0118(88); PC-AEO Run ADGQ317, 01/03/90.

Table D6. Electricity Supply, Disposition, and Prices: LOW GROWTH
(Generation in Billion Kilowatthours)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Electric Utilities								
Generation by Fuel Type								
Coal	1,538	1,527	1,525	1,701	1,828	2,059	2,404	2.1%
Petroleum	149	150	123	172	180	171	150	0.0%
Natural Gas	253	253	242	344	523	563	544	3.5%
Nuclear Power	527	521	550	558	572	592	595	0.6%
Pumped/Other Storage ^a	-9	-9	-9	-10	-10	-11	-12	1.3%
Hydropower/Other ^b	244	291	315	320	322	336	352	1.7%
Total Generation ^c	2,702	2,734	2,746	3,085	3,415	3,711	4,033	1.8%
Net Imports	32	26	27	46	60	64	68	3.5%
Nonutility Purchases	69	74	88	128	188	235	282	6.6%
Electricity Sales by Sector								
Residential	895	890	923	1,035	1,136	1,224	1,309	1.7%
Commercial/Other ^d	785	817	846	977	1,105	1,237	1,372	2.6%
Industrial	900	899	884	1,000	1,139	1,256	1,397	2.0%
Total Electricity Sales ^e	2,580	2,607	2,653	3,012	3,380	3,717	4,079	2.1%
Nonutilities								
Generation by Fuel Type								
Coal	28	31	34	36	45	66	91	5.5%
Petroleum	4	5	5	5	6	7	8	2.6%
Natural Gas	76	84	98	108	130	140	151	3.2%
Other Fossil ^f	12	12	12	13	13	14	15	1.0%
Pumped/Other Storage ^a	0	0	0	0	0	-1	-2	
Renewable Sources ^g	59	60	61	90	123	156	189	5.5%
Total Generation ^c	178	192	211	252	317	381	451	4.4%
Sales to Utilities	69	74	88	128	188	235	282	6.6%
Generation for Own Use	109	118	123	124	129	146	169	2.1%
End-Use Prices (1989 cents per kilowatthour)								
Residential	7.80	7.65	7.52	7.35	7.48	7.65	7.80	0.0%
Commercial	7.26	7.10	6.98	6.79	6.91	7.09	7.24	0.0%
Industrial	4.91	4.80	4.72	4.42	4.54	4.73	4.88	0.0%
Average to All Sectors ^h	6.62	6.49	6.41	6.19	6.30	6.47	6.61	0.0%

^a Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^b "Other" includes geothermal, petroleum coke, biomass, wood, waste, solar, and wind.

^c Includes transmission and distribution losses.

^d "Other" includes sales of electricity to Government, railways, and street lighting authorities.

^e Total is lower by 171 billion kilowatthours in 2010 because of demand side management programs.

^f Includes petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, non-fossil waste, solar, and wind.

^h Weighted average price, including transportation. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels, PC-AEO Run ADGQ317, 01/03/90.

Table D7. Electricity Generating Capability: LOW GROWTH
(Million Kilewatts)

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Electric Utility Capability							
Net Summer Capability *							
Coal Steam	294.6	296.6	297.0	300.3	312.6	348.8	406.0 1.5%
Other Fossil Steam	144.6	144.3	144.2	137.0	130.5	123.8	120.1 -0.8%
Combined Cycle	4.9	5.0	5.1	9.8	27.9	35.3	42.5 10.3%
Turbine/Diesel	44.5	45.9	46.1	51.6	67.5	72.0	79.7 2.7%
Nuclear	94.7	97.0	99.3	102.8	103.8	103.8	99.7 0.2%
Pumped/Other Storage	17.0	17.0	17.0	19.5	19.5	21.0	22.5 1.3%
Hydroelectric/Other	77.6	77.7	77.9	79.1	80.0	82.1	84.6 0.4%
Total Utility Capability	677.9	683.4	686.6	700.2	741.8	786.8	855.1 1.1%
Cumulative Planned Additions *							
Coal Steam	0.0	2.0	3.0	10.5	15.9	16.9	17.2
Other Fossil Steam	0.0	0.0	0.0	0.5	0.6	0.6	0.6
Combined Cycle	0.0	0.0	0.1	2.5	3.0	3.9	3.0
Turbine/Diesel	0.0	1.5	1.7	4.3	8.9	9.1	9.1
Nuclear	0.0	3.4	5.7	9.2	10.4	10.4	11.6
Pumped/Other Storage	0.0	0.0	0.0	2.5	2.5	2.5	2.5
Hydroelectric/Other	0.0	0.2	0.4	1.7	2.2	2.2	2.2
Total Planned Additions	0.0	7.1	11.0	31.2	43.5	44.7	46.1
Cumulative Unplanned Additions *							
Coal Steam	0.0	0.0	0.0	0.0	13.0	51.7	112.2
Combined Cycle	0.0	0.0	0.0	2.4	20.0	27.3	34.5
Turbine/Diesel	0.0	0.0	0.0	3.2	14.8	20.4	28.1
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumped/Other Storage	0.0	0.0	0.0	0.0	0.0	1.5	3.0
Hydroelectric/Other	0.0	0.0	0.0	0.0	0.3	4.0	7.9
Total Unplanned Additions	0.0	0.0	0.0	5.5	48.0	104.9	185.8
Cumulative Retirements *	0.0	1.5	2.3	14.4	27.5	40.6	54.7
Nonutility Capability							
Coal	5.4	6.0	6.8	7.6	9.3	13.8	19.0 5.9%
Natural Gas	12.2	13.9	17.0	19.6	23.7	25.6	27.8 3.8%
Other Fossil	4.0	4.2	4.5	4.7	5.2	5.8	6.5 2.2%
Renewable Sources/Other	9.8	10.0	10.2	16.4	22.4	30.8	39.2 6.5%
Total Nonutility Capability	31.5	34.1	38.5	48.3	60.6	76.1	92.5 5.0%

* The steady hourly output that generating equipment may supply to system load during summer-peak demand.

* Includes natural gas, oil, and dual-fired oil/natural gas combined cycle capability.

* Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

* Includes geothermal, wood, waste, solar, and wind.

* Cumulative additions from December 31, 1988.

* Includes petroleum, petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

* Includes hydroelectric, biomass, geothermal, wood, nonfossil waste, solar and wind, and pumped/other storage.

Source: Energy Information Administration, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run ADGQ317, 01/03/90

Table D8. Residential Consumption and Price of Energy by Fuel: LOW GROWTH

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	1.08	1.02	1.03	0.82	0.70	0.63	0.58	-2.8%
Liquefied Petroleum Gas	0.43	0.44	0.45	0.34	0.27	0.23	0.20	-3.5%
Natural Gas	4.77	4.78	4.92	4.83	4.78	4.74	4.68	-0.1%
Electricity	3.05	3.04	3.15	3.53	3.88	4.18	4.47	1.7%
Renewables	0.92	0.93	0.93	0.98	1.05	1.12	1.20	1.2%
Other *	0.16	0.16	0.16	0.18	0.19	0.20	0.21	1.2%
Total	10.42	10.37	10.64	10.67	10.88	11.10	11.33	0.4%
Prices (1989 dollars per million Btu)								
Distillate	6.05	6.20	6.07	6.91	8.07	9.05	9.82	2.2%
Liquefied Petroleum Gas	8.81	8.57	8.85	8.72	9.15	9.98	11.01	1.0%
Natural Gas	5.53	5.49	5.38	5.70	6.60	7.33	8.25	1.8%
Electricity	22.86	22.41	22.04	21.55	21.92	22.42	22.85	0.0%

* Includes kerosene and steam coal.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run ADGQ317, 01/03/90.

Table D9. Commercial Consumption and Price of Energy by Fuel: LOW GROWTH

	Year						Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010
Consumption (Quadrillion Btu)							
Distillate	0.62	0.59	0.59	0.52	0.44	0.39	0.37
Natural Gas	2.75	2.70	2.75	2.75	2.68	2.66	2.65
Electricity	2.66	2.77	2.87	3.32	3.75	4.20	4.66
Other *	0.59	0.56	0.52	0.48	0.44	0.41	0.40
Total	6.63	6.62	6.73	7.06	7.32	7.67	8.08
Prices (1989 dollars per million Btu)							
Distillate	4.73	4.85	4.75	5.56	6.70	7.65	8.41
Natural Gas	4.69	4.64	4.67	4.86	5.77	6.50	7.42
Electricity	21.26	20.81	20.46	19.89	20.26	20.78	21.21

* Includes kerosene, motor gasoline, residual fuel, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates, PC-AEO Run ADGQ317, 01/03/90.

Table D10. Transportation Consumption and Price of Energy by Fuel: LOW GROWTH

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Consumption (Quadrillion Btu)							
Distillate	3.53	3.60	3.65	3.94	4.22	4.49	4.82 1.4%
Jet Fuel	2.98	3.03	2.99	3.14	3.27	3.44	3.64 0.9%
Motor Gasoline	13.78	13.75	13.78	14.07	14.45	14.92	15.59 0.6%
Residual Fuel	0.80	0.71	0.64	0.70	0.76	0.83	0.90 0.5%
Other *	0.92	0.89	0.95	0.96	1.05	1.07	1.08 0.7%
Total	22.02	21.97	22.01	22.81	23.75	24.75	26.03 0.8%
Prices (1989 dollars per million Btu)							
Distillate	6.84	6.95	6.65	7.47	8.62	9.59	10.35 1.9%
Jet Fuel	3.96	4.21	4.01	4.94	6.24	7.33	8.19 3.4%
Motor Gasoline	8.03	8.51	8.33	8.23	9.79	10.73	11.45 1.6%
Residual Fuel	2.10	2.33	2.35	3.02	4.29	5.14	5.82 4.7%

* Includes kerosene, electricity, liquefied petroleum gas, lubricants, waxes, natural gas, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run ADGQ317, 01/03/90.

Table D11. Industrial Consumption and Price of Energy by Fuel: LOW GROWTH

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	1.32	1.28	1.22	1.30	1.29	1.30	1.35	0.1%
Liquefied Petroleum Gas	1.66	1.69	1.72	1.91	2.16	2.33	2.50	1.9%
Petrochemical Feedstocks	0.94	0.93	0.93	1.06	1.17	1.27	1.41	1.9%
Residual Fuel	0.67	0.59	0.53	0.48	0.44	0.43	0.44	-1.9%
Natural Gas	7.71	8.03	7.90	8.41	8.51	8.37	8.24	0.3%
Metallurgical Coal	1.08	1.04	1.07	1.10	1.02	0.94	0.87	-1.0%
Steam Coal	1.69	1.69	1.69	1.68	1.71	1.83	2.25	-1.3%
Electricity	3.07	3.07	3.02	3.41	3.89	4.28	4.77	2.0%
Renewables	2.43	2.45	2.46	2.94	3.45	3.95	4.44	2.8%
Other ^a	4.01	3.98	4.15	4.14	4.10	4.11	4.15	0.2%
Total	24.57	24.74	24.67	26.43	27.73	28.81	30.42	1.0%
Prices (1989 dollars per million Btu)								
Distillate	4.36	4.47	4.37	5.20	6.35	7.32	8.09	2.8%
Liquefied Petroleum Gas	5.43	5.27	5.45	5.40	5.83	6.65	7.65	1.6%
Residual Fuel	2.22	2.46	2.48	3.15	4.42	5.28	5.95	4.6%
Natural Gas	2.97	2.89	2.98	3.05	3.99	4.71	5.60	2.9%
Metallurgical Coal	1.85	1.84	1.84	1.88	1.97	2.06	2.15	0.7%
Steam Coal	1.56	1.55	1.55	1.59	1.67	1.75	1.83	0.7%
Hydroelectric Power	12.83	12.83	12.83	12.83	12.83	12.83	12.83	0.0%
Electricity	14.38	14.07	13.84	12.96	13.31	13.85	14.31	0.0%

^a Includes liquefied petroleum gas, lubricants, waxes, motor gasoline, and hydropower.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0037(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run ADGQ317, 01/03/90.

Appendix E

High Growth Case Forecasts

- **Resource Prices, Economic Growth, and Energy Efficiency**
- **Total Energy Supply, Disposition, and Prices**
- **Petroleum Supply, Disposition, and Prices**
- **Natural Gas Supply, Disposition, and Prices**
- **Coal Supply, Disposition, and Prices**
- **Electricity Supply, Disposition, and Prices**
- **Electricity Generating Capability**
- **Residential Consumption and Price of Energy by Fuel**
- **Commercial Consumption and Price of Energy by Fuel**
- **Transportation Consumption and Price of Energy by Fuel**
- **Industrial Consumption and Price of Energy by Fuel**

Table E1. Resource Prices, Economic Growth, and Energy Efficiency: HIGH GROWTH

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Prices								
World Oil Price ^a (1989 dollars per barrel)	15.27	17.70	16.80	20.40	27.80	32.90	36.90	4.1%
Domestic Natural Gas Wellhead (1989 dollars per 1,000 cubic feet)	1.76	1.78	1.82	2.56	3.78	4.87	6.09	5.8%
Domestic Coal Minemouth (1989 dollars per short ton)	23.02	23.00	22.90	24.20	25.67	27.72	29.76	1.2%
Economic Indicators ^b								
Real Gross National Product (billion 1982 dollars)	4.024	4.156	4.301	4.985	5.697	6.514	7.331	2.8%
Percentage Change from Prior Year	4.4%	3.3%	3.5%	3.4%	2.3%	2.7%	2.2%	
GNP Implicit Price Deflator (index 1982=1.000)	1.213	1.265	1.309	1.503	1.851	2.262	2.853	4.0%
Percentage Change from Prior Year	3.3%	4.3%	3.5%	4.0%	4.3%	4.4%	4.9%	
Real Disposable Personal Income (billion 1982 dollars)	2.793	2.914	2.998	3.332	3.718	4.143	4.617	2.3%
Percentage Change from Prior Year	4.3%	4.3%	2.9%	2.6%	1.9%	2.3%	2.0%	
Index of Manufacturing Production (index 1982=1.000)	1.219	1.254	1.315	1.558	1.852	2.164	2.502	3.3%
Percentage Change from Prior Year	5.0%	2.9%	4.8%	3.6%	3.1%	3.1%	3.2%	
Energy Efficiency (thousand Btu per 1982 dollar of GNP)								
Oil & Gas Use	13.12	12.78	12.68	11.84	11.10	9.93	8.97	-1.7%
Electricity Use	2.19	2.15	2.16	2.16	2.16	2.12	2.11	-0.2%
Total Energy Use	20.72	20.29	20.09	18.79	17.57	16.31	15.36	-1.3%

^a Cost of imported crude oil to U.S. refiners.

^b Seasonally adjusted at annual rates.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); U.S. Department of Commerce (DoC), Bureau of Economic Analysis, *Survey of Current Business*, July 1989; DoC, Office of Business Analysis; PC-AEO Run ACDY831, 01/03/90.

Table E2. Total Energy Supply, Disposition, and Prices: HIGH GROWTH

Supply and Disposition	1988	1989	1990	1995	2000	2005	2010	Annual Percent Growth 1988-2010
Energy Summary (Quadrillion Btu)								
Primary Production								
Petroleum	19.5	18.5	17.9	16.1	15.2	14.1	12.8	-1.9%
Natural Gas	17.5	17.5	18.1	20.1	22.3	22.1	20.9	0.8%
Coal	20.7	21.3	21.7	24.1	26.4	31.7	38.0	2.8%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy ^a	6.0	6.5	6.8	7.7	8.3	9.2	10.1	2.4%
Total Production	69.4	69.4	70.4	74.0	78.4	83.6	88.3	1.1%
Net Imports								
Petroleum (including SPR)	13.9	15.5	16.8	20.1	22.1	24.8	28.1	3.2%
Natural Gas	1.2	1.3	1.4	2.1	2.8	3.1	3.2	4.5%
Coal/Other (- indicates export) ^b	-2.1	-2.2	-2.1	-2.6	-3.3	-4.7	-6.5	5.3%
Total Net Imports	13.1	14.5	16.1	19.6	21.6	23.1	24.8	3.0%
Consumption								
Petroleum Products	34.2	34.1	35.0	36.9	38.4	39.8	42.0	0.9%
Natural Gas	18.6	19.0	19.6	22.1	24.8	24.9	23.7	1.1%
Coal	18.8	19.0	19.1	20.8	22.2	25.8	30.1	2.2%
Nuclear Power	5.7	5.6	5.9	6.1	6.2	6.5	6.5	0.6%
Renewable Energy/Other ^c	6.1	6.6	6.9	7.7	8.5	9.4	10.3	2.4%
Total Consumption^d	83.4	84.3	86.4	93.7	100.1	106.3	112.6	1.4%
Discrepancy ^e	-0.9	-0.4	0.0	-0.1	0.0	0.5	0.5	
End-Use Prices (1989 dollars per million Btu)								
Residential								
Heating Oil	6.05	6.20	6.15	7.04	8.32	9.37	10.24	2.4%
Natural Gas	5.53	5.49	5.45	6.31	7.49	8.55	9.72	2.6%
Electricity	22.86	22.41	22.33	23.30	24.26	25.11	25.30	0.5%
Industrial								
Residual Fuel Oil	2.22	2.46	2.51	3.45	4.73	5.52	6.24	4.8%
Natural Gas	2.97	2.89	3.02	3.67	4.88	5.94	7.07	4.0%
Transportation								
Motor Gasoline	8.03	8.51	8.44	9.52	10.98	11.81	12.43	2.0%
Diesel Oil	6.84	6.95	6.73	7.60	8.87	9.92	10.78	2.1%
Electric Utilities								
Coal	1.54	1.46	1.47	1.61	1.68	1.78	1.88	0.9%
Heavy Oil	2.52	2.78	2.77	3.60	4.82	5.62	6.38	4.3%
Natural Gas	2.36	2.36	2.41	3.19	4.35	5.41	6.44	4.7%

^a Includes utility and nonutility generation of hydroelectric power; geothermal, wood, waste, wind, photovoltaic, and solar thermal sources for electricity generation; and renewables consumed for non-electric purposes.

^b Includes coal, net coal coke imports, and net electricity imports (fuel input equivalent).

^c Same as footnote *a*, plus net electricity imports and net coal coke imports, and minus biofuels for transportation.

^d Includes 3.1 quadrillion Btus of renewable energy in 1988 that are not reported in EIA's *Monthly Energy Review*.

^e A balancing item. Includes stock changes, unaccounted for supply, losses, and gains.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run ACDY831, 01/03/90.

Table E3. Petroleum Supply, Disposition, and Prices: HIGH GROWTH
(Quantities in Million Barrels per Day)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Petroleum Production								
Crude Oil	8.14	7.67	7.37	6.40	5.86	5.35	4.78	-2.4%
Alaska	2.02	1.87	1.84	1.28	0.96	0.65	0.46	-6.5%
Lower 48 States	6.12	5.79	5.54	5.12	4.90	4.70	4.33	-1.6%
Natural Gas Liquids	1.62	1.60	1.62	1.81	2.03	2.01	1.89	0.7%
Other *	0.71	0.71	0.74	0.82	0.93	1.06	1.23	2.5%
Total Production	10.47	9.97	9.73	9.03	8.81	8.41	7.90	-1.3%
Net Imports (including SPR)								
Crude Oil	4.95	5.74	6.15	7.59	8.47	9.62	11.15	3.8%
Refined Products	1.63	1.57	1.75	1.91	1.98	2.01	2.13	1.2%
Total Net Imports	6.59	7.31	7.90	9.50	10.45	11.63	13.28	3.2%
Net Storage Withdrawals *								
Crude Oil and Products (excl. SPR)	0.08	-0.11	-0.01	0.05	0.06	0.03	0.02	-5.6%
SPR Fill Rate (-)	-0.05	-0.06	-0.05	-0.05	0.00	0.00	0.00	
Petroleum Product Supplied								
Motor Gasoline	7.34	7.35	7.47	7.54	7.74	8.07	8.47	0.7%
Jet Fuel	1.45	1.48	1.54	1.72	1.87	2.04	2.20	1.9%
Distillate Fuel	3.12	3.13	3.24	3.44	3.57	3.74	3.95	1.1%
Residual Fuel	1.38	1.32	1.26	1.55	1.60	1.44	1.56	0.6%
Liquefied Petroleum Gases	1.66	1.70	1.81	1.94	2.14	2.28	2.40	1.7%
Other *	2.34	2.30	2.39	2.47	2.55	2.66	2.77	0.8%
Total Products Supplied	17.28	17.28	17.70	18.67	19.47	20.23	21.36	1.0%
Unaccounted for ^d	0.20	0.17	0.14	0.15	0.15	0.15	0.15	
World Oil Price *								
(1989 dollars per barrel)	15.27	17.70	16.80	20.40	27.80	32.90	36.90	4.1%
End-Use Prices (1989 dollars per gallon)								
Motor Gasoline (incl. tax)	1.00	1.06	1.06	1.19	1.37	1.48	1.56	2.0%
Propane	0.54	0.53	0.55	0.54	0.58	0.67	0.78	1.7%
Jet Fuel	0.53	0.56	0.54	0.68	0.87	1.02	1.15	3.6%
No. 2 Heating Oil	0.84	0.86	0.85	0.98	1.15	1.30	1.42	2.4%
Residual Fuel (dollars per barrel)	14.65	16.29	16.36	21.81	29.59	34.41	39.05	4.6%

^a Includes refinery processing gain, and other hydrocarbons and alcohol.

^b A negative (-) result represents an increase to inventories and a decrease to total supply.

^c Includes crude oil supplied as product, unfinished oils, and all other finished petroleum products not noted here.

^d A balancing item: unaccounted for crude oil supply.

^e Cost of imported crude oil to U.S. refiners.

SPR: Strategic Petroleum Reserve.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Petroleum Marketing Monthly*, DOE/EIA-0380(89/07); PC-AEO Run ACDY831, 01/03/90.

Table E4. Natural Gas Supply, Disposition, and Prices: HIGH GROWTH
(Quantities in Trillion Cubic Feet)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Natural Gas Production								
Dry Gas Production	16.99	16.98	17.60	19.52	21.62	21.44	20.27	0.8%
Supplemental Gas ^a	0.10	0.16	0.18	0.15	0.17	0.23	0.30	5.1%
Net Imports	1.22	1.26	1.43	2.11	2.81	3.14	3.24	4.5%
Net Storage Withdrawals ^b	0.06	0.04	0.01	0.00	0.00	0.00	0.00	
Consumption by Sector								
Residential	4.63	4.64	4.78	4.69	4.70	4.69	4.67	0.0%
Commercial	2.67	2.62	2.66	2.64	2.57	2.54	2.53	-0.2%
Industrial	6.38	6.74	7.03	7.53	7.73	7.74	7.79	0.9%
Electric Utilities	2.64	2.66	2.66	4.53	6.79	6.88	5.88	3.7%
Lease and Plant Fuel	1.10	1.16	1.21	1.37	1.51	1.50	1.42	1.2%
Pipeline Fuel	0.61	0.59	0.68	0.68	0.76	0.75	0.71	0.7%
Total Consumption	18.03	18.41	19.01	21.44	24.06	24.11	23.00	1.1%
Unaccounted for ^c	0.34	0.03	0.20	0.34	0.54	0.70	0.81	
Average Wellhead Price (1989 dollars per 1,000 cubic feet)	1.76	1.78	1.82	2.56	3.78	4.87	6.09	5.8%
End-Use Prices (1989 dollars per 1,000 cubic feet)								
Residential	5.70	5.66	5.62	6.50	7.73	8.81	10.02	2.6%
Commercial	4.83	4.78	4.88	5.64	6.87	7.96	9.17	3.0%
Industrial	3.06	2.98	3.12	3.78	5.03	6.12	7.29	4.0%
Electric Utilities	2.43	2.44	2.48	3.29	4.49	5.58	6.64	4.7%
Average to All Sectors ^d	4.00	3.92	3.99	4.58	5.66	6.74	7.95	3.2%

^a Includes synthetic natural gas (results from the manufacture, conversion, or reforming of petroleum and coal hydrocarbons), and propane-air mixtures.

^b Includes net withdrawals of dry natural gas from underground storage and liquefied natural gas. A negative (-) result represents an increase to inventories and a decrease to total supply. A positive result represents a withdrawal from inventories and an increase to total supply.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Weighted average price. Weights used are consumption values by sector, excluding lease and plant fuel and pipeline use.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Natural Gas Monthly*, DOE/EIA-0130(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); PC-AEO Run AC DY831, 01/03/90.

Table E5. Coal Supply, Disposition, and Prices: HIGH GROWTH
(Quantities in Million Short Tons)

	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Coal Production ^a	950	975	994	1,106	1,212	1,453	1,736	2.8%
Net Imports (- indicates exports)	-93	-95	-92	-116	-151	-211	-280	5.1%
Imports	2	2	2	5	8	10	12	8.2%
Exports	95	97	95	121	158	221	292	5.2%
Net Storage Withdrawals ^b	25	11	-2	-2	-3	-7	-10	
Consumption by Sector								
Residential/Commercial	7	7	6	6	5	5	4	-2.6%
Industrial								
Coke Plants	42	42	42	43	40	37	34	-0.9%
Other Industrial	76	77	78	82	87	97	120	2.1%
Electric Utilities	758	760	774	856	927	1096	1288	2.4%
Total Consumption	883	886	900	988	1,059	1,235	1,446	2.3%
Discrepancy ^c	-1	5	0	0	0	0	0	
Average Minemouth Price (1989 dollars per short ton) ^d	23.02	23.00	22.90	24.20	25.67	27.72	29.76	1.2%
End-Use Prices (1989 dollars per short ton)								
Residential/Commercial	49.57	48.76	48.65	51.23	53.40	56.07	58.77	0.8%
Coke Plants	49.74	49.32	49.26	51.62	54.11	57.13	60.21	0.9%
Other Industrial	34.86	34.39	34.40	36.07	37.68	39.73	41.71	0.8%
Electric Utilities	31.98	30.55	30.33	33.28	34.61	36.62	38.69	0.9%
Average to All Sectors ^e	33.22	31.92	31.69	34.42	35.69	37.55	39.50	0.8%

^a Includes anthracite, bituminous coal, and lignite.

^b From all stocks held by industrial plants, coke plants, electric utilities, and producers/distributors. A negative (-) result represents an increase to inventories. A positive result represents a withdrawal from inventories.

^c A balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.

^d Free-on-board price.

^e Weighted average prices. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Quarterly Coal Report*, DOE/EIA-0121(89/2Q); *Coal Production 1988*, DOE/EIA-0118(88); PC-AEO Run ACY831, 01/03/90.

Table E6. Electricity Supply, Disposition, and Prices: HIGH GROWTH
(Generation in Billion Kilowatthours)

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Electric Utilities								
Generation by Fuel Type								
Coal	1,538	1,537	1,596	1,713	1,845	2,202	2,680	2.6%
Petroleum	149	152	138	201	214	174	191	1.1%
Natural Gas	253	254	255	421	668	712	628	4.2%
Nuclear Power	527	521	550	558	572	592	595	0.6%
Pumped/Other Storage ^a	-9	-9	-9	-10	-10	-11	-12	1.3%
Hydropower/Other ^b	244	291	315	320	322	336	350	1.7%
Total Generation^c	2,702	2,747	2,845	3,202	3,610	4,004	4,433	2.3%
Net Imports	32	26	27	46	60	64	68	3.5%
Nonutility Purchases	69	74	88	153	227	292	361	7.8%
Electricity Sales by Sector								
Residential	895	891	932	1,059	1,177	1,287	1,397	2.0%
Commercial/Other ^d	785	819	860	996	1,137	1,289	1,449	2.8%
Industrial	900	906	933	1,101	1,289	1,473	1,687	2.9%
Total Electricity Sales^e	2,580	2,616	2,725	3,156	3,603	4,049	4,533	2.6%
Nonutilities								
Generation by Fuel Type								
Coal	28	31	34	49	62	100	142	7.7%
Petroleum	4	5	5	7	8	10	11	4.5%
Natural Gas	76	84	98	143	176	198	225	5.1%
Other Fossil ^f	12	12	12	13	13	14	15	1.0%
Pumped/Other Storage ^a	0	0	0	0	0	-1	-2	
Renewable Sources ^g	50	60	61	90	123	156	189	5.5%
Total Generation^c	178	192	211	301	383	476	580	5.6%
Sales to Utilities	69	74	88	153	227	292	361	7.8%
Generation for Own Use	109	118	123	148	156	184	219	3.2%
End-Use Prices (1989 cents per kilowatthour)								
Residential	7.80	7.65	7.62	7.95	8.28	8.57	8.63	0.5%
Commercial	7.26	7.10	7.07	7.39	7.71	8.00	8.07	0.5%
Industrial	4.91	4.80	4.78	5.00	5.32	5.60	5.66	0.6%
Average to All Sectors^h	6.62	6.49	6.47	6.74	7.04	7.31	7.34	0.5%

^a Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^b "Other" includes geothermal, petroleum coke, biomass, wood, waste, solar, and wind.

^c Includes transmission and distribution losses.

^d "Other" includes sales of electricity to Government, railways, and street lighting authorities.

^e Total is lower by 171 billion kilowatthours in 2010 because of demand side management programs.

^f Includes petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, non-fossil waste, solar, and wind.

^h Weighted average price, including transportation. Weights used are consumption values by sector.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *Electric Power Monthly*, DOE/EIA-0226(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels: PC-AEO Run AC DY831, 01/03/90.

Table E7. Electricity Generating Capability: HIGH GROWTH
(Million Kilowatts)

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Electric Utility Capability							
Net Summer Capability^a							
Coal Steam	294.6	296.6	297.0	300.3	314.4	371.7	451.3 2.0%
Other Fossil Steam	144.6	144.3	144.2	137.0	130.5	123.8	120.1 -0.8%
Combined Cycle ^b	4.9	5.0	5.1	11.3	46.3	67.6	75.1 13.2%
Turbine/Diesel	44.5	45.9	46.1	59.0	73.5	78.4	86.1 3.0%
Nuclear	94.7	97.0	99.3	102.8	103.8	103.8	99.7 0.2%
Pumped/Other Storage ^c	17.0	17.0	17.0	19.5	19.5	21.0	22.5 1.3%
Hydroelectric/Other ^d	77.6	77.7	77.9	79.1	80.0	82.1	84.6 0.4%
Total Utility Capability	677.9	683.4	686.6	709.0	768.0	848.5	939.4 1.5%
Cumulative Planned Additions^e							
Coal Steam	0.0	2.0	3.0	10.5	15.9	16.9	17.2
Other Fossil Steam	0.0	0.0	0.0	0.5	0.6	0.6	0.6
Combined Cycle ^b	0.0	0.0	0.1	2.5	3.0	3.0	3.0
Turbine/Diesel	0.0	1.5	1.7	4.3	8.9	9.1	9.1
Nuclear	0.0	3.4	5.7	9.2	10.4	10.4	11.6
Pumped/Other Storage ^c	0.0	0.0	0.0	2.5	2.5	2.5	2.5
Hydroelectric/Other ^d	0.0	0.2	0.4	1.7	2.2	2.2	2.2
Total Planned Additions	0.0	7.1	11.0	31.2	43.5	44.7	46.1
Cumulative Unplanned Additions^f							
Coal Steam	0.0	0.0	0.0	0.0	14.8	74.5	157.5
Combined Cycle ^b	0.0	0.0	0.0	3.8	38.4	59.7	67.2
Turbine/Diesel	0.0	0.0	0.0	10.6	20.8	26.9	34.6
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumped/Other Storage ^c	0.0	0.0	0.0	0.0	0.0	1.5	3.0
Hydroelectric/Other ^d	0.0	0.0	0.0	0.0	0.3	4.0	7.9
Total Unplanned Additions	0.0	0.0	0.0	14.4	74.2	166.6	270.1
Cumulative Retirements^g	0.0	1.5	2.3	14.4	27.5	40.6	54.7
Nonutility Capability							
Coal	5.4	6.0	6.8	10.2	12.9	20.8	29.5 8.0%
Natural Gas	12.2	13.9	17.0	26.1	32.5	36.6	41.8 5.7%
Other Fossil ^h	4.0	4.2	4.5	5.6	6.3	7.2	8.2 3.3%
Renewable Sources/Other ⁱ	9.8	10.0	10.2	16.4	22.4	30.8	39.2 6.5%
Total Nonutility Capability	31.5	34.1	38.5	58.3	74.1	95.4	118.7 6.2%

^a The steady hourly output that generating equipment may supply to system load during summer peak demand.

^b Includes natural gas, oil, and dual-fired oil/natural gas combined cycle capability.

^c Includes hydroelectric pumped storage and, after 2000, compressed air and battery storage.

^d Includes geothermal, wood, waste, solar, and wind.

^e Cumulative additions from December 31, 1988.

^f Includes petroleum, petroleum coke, waste heat, blast furnace gas, coke oven gas, and anthracite culm.

^g Includes hydroelectric, biomass, geothermal, wood, nonfossil waste, solar and wind, and pumped/other storage.

Source: Energy Information Administration, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run ACDY831, 01/03/90.

Table E8. Residential Consumption and Price of Energy by Fuel: HIGH GROWTH

	Year						Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010 1988-2010
Consumption (Quadrillion Btu)							
Distillate	1.08	1.02	1.03	0.85	0.75	0.69	0.65 -2.2%
Liquefied Petroleum Gas	0.43	0.44	0.47	0.36	0.29	0.25	0.22 -3.1%
Natural Gas	4.77	4.78	4.92	4.84	4.85	4.84	4.82 0.0%
Electricity	3.05	3.04	3.18	3.61	4.01	4.39	4.77 2.0%
Renewables	0.92	0.93	0.93	0.98	1.05	1.12	1.20 1.2%
Other *	0.16	0.16	0.16	0.18	0.19	0.20	0.21 1.2%
Total	10.42	10.37	10.70	10.82	11.14	11.49	11.86 0.6%
Prices (1989 dollars per million Btu)							
Distillate	6.05	6.20	6.15	7.04	8.32	9.37	10.24 2.4%
Liquefied Petroleum Gas	8.81	8.57	8.97	9.02	9.55	10.68	12.06 1.4%
Natural Gas	5.53	5.49	5.45	6.31	7.49	8.55	9.72 2.6%
Electricity	22.86	22.41	22.33	23.30	24.26	25.11	25.30 0.5%

* Includes kerosene and steam coal.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10);

State Energy Price and Expenditure Report 1985, DOE/EIA-0376(85); values for 1987 are estimates, PC-AEO Run ACDY831, 01/03/90.

Table E9. Commercial Consumption and Price of Energy by Fuel: HIGH GROWTH

	Year							Annual Percent Growth
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	0.62	0.59	0.59	0.53	0.46	0.41	0.39	-2.1%
Natural Gas	2.75	2.70	2.75	2.72	2.65	2.62	2.61	-0.2%
Electricity	2.66	2.78	2.92	3.38	3.86	4.38	4.92	2.8%
Other *	0.59	0.56	0.55	0.51	0.48	0.45	0.43	-1.4%
Total	6.63	6.63	6.82	7.14	7.45	7.87	8.36	1.1%
Prices (1989 dollars per million Btu)								
Distillate	4.73	4.85	4.81	5.68	6.93	7.97	8.83	2.9%
Natural Gas	4.69	4.64	4.73	5.47	6.66	7.72	8.89	3.0%
Electricity	21.26	20.81	20.73	21.65	22.61	23.46	23.65	0.5%

* Includes kerosene, motor gasoline, residual fuel, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run ACDY831, 01/03/90.

Table E10. Transportation Consumption and Price of Energy by Fuel: HIGH GROWTH

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010	1988-2010
Consumption (Quadrillion Btu)								
Distillate	3.53	3.63	3.86	4.26	4.66	5.08	5.50	2.0%
Jet Fuel	2.98	3.04	3.16	3.53	3.83	4.20	4.51	1.9%
Motor Gasoline	13.78	13.77	13.99	14.09	14.43	15.02	15.77	0.6%
Residual Fuel	0.80	0.72	0.71	0.80	0.89	0.98	1.08	1.3%
Other *	0.92	0.90	1.00	1.03	1.14	1.17	1.15	1.0%
Total	22.02	22.06	22.72	23.71	24.96	26.45	28.01	1.1%
Prices (1989 dollars per million Btu)								
Distillate	6.84	6.95	6.73	7.60	8.87	9.92	10.78	2.1%
Jet Fuel	3.96	4.21	4.07	5.05	6.47	7.65	8.62	3.6%
Motor Gasoline	8.03	8.51	8.44	9.52	10.98	11.81	12.43	2.0%
Residual Fuel	2.10	2.33	2.38	3.10	4.38	5.17	5.88	4.8%

* Includes kerosene, electricity, liquefied petroleum gas, lubricants, waxes, natural gas, and renewables.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates. PC-AEO Run ACDY831, 01/03/90.

Table E11. Industrial Consumption and Price of Energy by Fuel: HIGH GROWTH

	Year						Annual Percent Growth	
	1988	1989	1990	1995	2000	2005	2010 1988-2010	
Consumption (Quadrillion Btu)								
Distillate	1.32	1.29	1.30	1.48	1.53	1.58	1.67	1.1%
Liquefied Petroleum Gas	1.66	1.70	1.81	2.11	2.44	2.67	2.88	2.5%
Petrochemical Feedstocks	0.94	0.94	0.99	1.15	1.30	1.47	1.64	2.6%
Residual Fuel	0.67	0.60	0.59	0.55	0.52	0.53	0.55	-0.9%
Natural Gas	7.71	8.14	8.49	9.17	9.53	9.53	9.49	1.0%
Metallurgical Coal	1.08	1.04	1.13	1.16	1.07	0.99	0.91	-0.8%
Steam Coal	1.69	1.69	1.73	1.81	1.89	2.11	2.61	2.0%
Electricity	3.07	3.09	3.18	3.76	4.40	5.03	5.76	2.9%
Renewables	2.43	2.45	2.46	2.94	3.45	3.95	4.44	2.8%
Other *	4.01	3.98	4.16	4.16	4.15	4.19	4.24	0.3%
Total	24.57	24.92	25.83	28.29	30.27	32.04	34.18	1.5%
Prices (1989 dollars per million Btu)								
Distillate	4.36	4.47	4.43	5.30	6.57	7.62	8.49	3.1%
Liquefied Petroleum Gas	5.43	5.27	5.52	5.66	6.20	7.31	8.66	2.1%
Residual Fuel	2.22	2.46	2.51	3.45	4.73	5.52	6.24	4.8%
Natural Gas	2.97	2.89	3.02	3.67	4.88	5.94	7.07	4.0%
Metallurgical Coal	1.85	1.84	1.84	1.93	2.02	2.13	2.25	0.9%
Steam Coal	1.56	1.55	1.55	1.64	1.73	1.83	1.93	1.0%
Hydroelectric Power	12.83	12.83	12.83	12.83	12.83	12.83	12.83	0.0%
Electricity	14.38	14.07	14.02	14.66	15.58	16.41	16.58	0.6%

^a Includes kerosene, liquefied petroleum gas, lubricants, waxes, motor gasoline, and hydropower.

Notes: Historical values are through 1986. Total may not equal sum of components due to independent rounding.

Sources: Historical data: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(87/10); *State Energy Price and Expenditure Report 1985*, DOE/EIA-0376(85); values for 1987 are estimates, PC-AEO Run ACY831, 01/03/90.

Appendix F

Other Energy Forecasts

- **International Petroleum Supply and Disposition**
- **Renewable Energy Consumption**

Table F1. International Petroleum Supply and Disposition: BASE
(Million Barrels per Day)

	Year							Annual Percent Growth
Supply and Disposition	1988	1989	1990	1995	2000	2005	2010	1988-2010
Market Economies								
Production^a								
U.S. (50 States)	10.47	9.97	9.71	8.97	8.71	8.29	7.83	-1.3%
Canada	2.04	1.99	1.96	2.03	2.10	2.13	2.10	0.1%
OECD Europe	4.44	4.47	4.96	5.29	5.16	4.88	4.44	0.0%
OPEC	22.01	23.44	23.68	26.58	28.47	30.89	34.05	2.0%
Other Countries	10.11	10.24	10.67	11.06	10.73	10.47	10.37	0.1%
Net CPE Exports	2.43	2.30	2.20	1.92	1.53	0.79	-0.07	
Total Supply ^b	51.12	51.61	52.73	55.80	56.72	57.45	58.73	0.6%
Consumption								
U.S. (50 States)	17.28	17.25	17.41	18.21	18.84	19.47	20.32	0.7%
U.S. Territories	0.20	0.21	0.20	0.21	0.22	0.22	0.23	0.6%
Canada	1.60	1.67	1.68	1.91	1.96	1.92	1.90	0.8%
Japan	4.73	5.01	5.20	5.77	5.65	5.33	5.02	0.3%
Australia and New Zealand	0.77	0.80	0.81	0.88	0.91	0.95	1.00	1.2%
OECD Europe	12.36	12.54	12.70	12.92	12.43	12.02	11.82	-0.2%
Other Market Economies	13.80	14.46	15.02	16.21	17.01	17.83	18.75	1.4%
Total Consumption	50.74	51.94	53.03	56.10	57.02	57.75	59.03	0.7%
Discrepancy	-0.39	0.33	0.29	0.30	0.30	0.30	0.30	
Centrally Planned Economies (CPE)								
Production								
China	2.73	2.73	2.81	2.82	2.77	2.66	2.50	-0.4%
U.S.S.R.	12.55	12.23	12.03	11.56	10.48	9.24	8.16	-1.9%
Other	0.46	0.47	0.51	0.42	0.35	0.29	0.24	-2.9%
Consumption								
China	2.13	2.14	2.12	2.11	2.09	2.07	2.02	-0.2%
U.S.S.R.	8.86	8.84	8.82	8.50	7.88	7.37	7.06	-1.0%
Other	2.51	2.36	2.40	2.28	2.10	1.95	1.89	-1.3%
World Oil Consumption	64.23	65.28	66.37	68.99	69.09	69.14	70.00	0.4%

^a Includes production of crude oil and natural gas liquids, other hydrogen and hydrocarbons for refinery feedstock, refinery gain, alcohol, and liquids produced from coal and other sources.

^b Includes net stock withdrawals.

Sources: Energy Information Administration (EIA); *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, *International Energy Annual 1988*, DOE/EIA-0219(88); Organization for Economic Cooperation and Development, *Monthly Oil Statistics Database* through December 1988; PC-AEO Run DACB212, 01/03/90.

Table F2. Renewable Energy Consumption: BASE
(Quadrillion Btu)

Sector and Source	Year							Annual Percent Growth 1988-2010
	1988	1989	1990	1995	2000	2005	2010	
Consumption by Sector								
Residential, Commercial, Industrial								
Biofuels ^a	3.09	3.11	3.12	3.55	3.99	4.39	4.80	2.0%
Hydropower	0.06	0.06	0.06	0.10	0.13	0.14	0.15	4.7%
Geothermal	0.13	0.14	0.14	0.17	0.22	0.30	0.39	5.1%
Ocean Thermal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Solar Energy								
Thermal	0.09	0.09	0.09	0.12	0.19	0.26	0.34	6.2%
Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.02	0.03	
Wind	0.03	0.03	0.03	0.05	0.06	0.09	0.12	6.1%
Transportation								
Biofuels (alcohol fuels) ^b	0.06	0.07	0.07	0.07	0.10	0.16	0.26	6.8%
Electric Utilities								
Biofuels ^c	0.02	0.02	0.02	0.02	0.02	0.04	0.06	5.0%
Hydropower	2.32	2.81	3.04	3.35	3.35	3.35	3.35	1.7%
Geothermal	0.22	0.22	0.22	0.22	0.24	0.33	0.42	3.0%
Ocean Thermal	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
Solar Energy								
Thermal	0.00	0.00	0.00	0.00	0.00	0.03	0.06	
Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.01	0.03	
Wind	0.00	0.00	0.00	0.00	0.00	0.05	0.10	
Total Renewable Energy	6.02	6.54	6.79	7.65	8.30	9.19	10.12	2.4%
Consumption by Use								
Electricity Generation								
Electric Utilities	2.56	3.05	3.28	3.59	3.61	3.82	4.03	2.1%
Nonutility Sales to Utilities	0.52	0.54	0.54	0.78	1.05	1.32	1.59	5.2%
Nonutil. Generation for Own Use	0.11	0.12	0.12	0.19	0.28	0.36	0.44	6.3%
Total Electric	3.19	3.70	3.94	4.56	4.95	5.49	6.05	2.9%
Other (Non-Electric)								
Residential	0.92	0.93	0.93	0.98	1.05	1.12	1.20	1.2%
Commercial	0.05	0.05	0.05	0.07	0.09	0.14	0.19	5.9%
Industrial	1.80	1.80	1.80	1.97	2.12	2.27	2.42	1.4%
Transportation	0.06	0.07	0.07	0.07	0.10	0.16	0.26	6.8%
Total Non-Electric	2.83	2.84	2.85	3.09	3.35	3.70	4.07	1.7%
Total Renewable Energy	6.02	6.54	6.79	7.65	8.30	9.19	10.12	2.4%

^a Includes wood, landfill and sewer gas, municipal solid waste, and waste heat from biomass sources.

^b Includes ethanol and methanol produced from biomass sources.

^c Includes electricity generation from utility wood and waste plants.

Sources: Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(89/07); EIA, Office of Coal, Nuclear, Electric & Alternate Fuels; PC-AEO Run DACB212, 01/03/90.

Appendix G
Data Sources

Data Sources for Tables and Figures

In general, all historical data can be found in the *Annual Energy Review 1988*, DOE/EIA-0384(88) (Washington, DC, 1989). For specific tables and figures, the following data sources were used:

Table 1. Summary of Projections for 2010

History (1988): *Annual Energy Review 1988*. Projections: Tables A1, A2, B1, B2, C1, C2, D1, D2, E1, and E2.

Figure 1. U.S. Refiners' Acquisition Cost of Imported Crude Oil, 1970-2010

History: *Annual Energy Review 1988*. Projections: *International Energy Outlook 1990*, DOE/EIA-0484(90).

Figure 2. OPEC Oil Production as Percent of Market Economy Demand, Base Case, 1973-2010

History: *Annual Energy Review 1988*. Projections: *International Energy Outlook 1990*, DOE/EIA-0484(90).

Figure 3. Average Annual Growth Rates for Selected Economic Indicators, Base Case

History: *Annual Energy Review 1988*. Projections: Table A1.

Table 2. Summary of Assumptions and Projections for the Market Economies

History: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(89/08), and *International Energy Annual 1988*, DOE/EIA-0219(88); Wharton Econometric Forecasting Associates, *World Economic Service Historical Data*, December 1989. Projections: Wharton Econometric Forecasting Associates, *World Economic Outlook*, October 1989; and EIA, Office of Energy Markets and End Use.

Figure 4. Changes in Sources of Energy, Base Case, 1988-2010

Projections: Table A2.

Figure 5. Changes in Energy Demands, Base Case, 1988-2010

Projections: Table A2.

Figure 6. Changes in Energy Demand by Major End-Use Sector, Base Case, 1988-2010

History: *Annual Energy Review 1988*. Projections: Tables A3, A4, A5, A6 and A8.

Figure 7. U.S. Energy Intensity, Base Case, 1988-2010

History: *Annual Energy Review 1988*. Projections: Table A1.

Figure 8. Changes in Average Efficiency for Selected Energy Uses, 1988-2010

Projections: Office of Energy Markets and End Use, EIA.

Figure 9. Petroleum Supply and Consumption, Base Case, 1970-2010

History: *Annual Energy Review 1988*. Projections: Table A3.

Figure 10. Ratio of Cash Flow to Fixed Assets for U.S. Oil and Gas Producers, Base Case, 1977-2010

History and Projections: Office of Energy Markets and End Use, EIA.

Figure 11. Changes in Determinants of Gasoline Demand, Base Case, 1988-2010

Projections: Office of Energy Markets and End Use, EIA.

Figure 12. Natural Gas Consumption and Production, Base Case, 1970-2010

History: *Annual Energy Review 1988*. Projections: Table A4.

Figure 13. Selected Residential Energy Prices, Base Case, 1970-2010

History: *Annual Energy Review 1988*. Projections: Table A1.

Figure 14. Coal Production and Total Energy Production, Base Case, 1989-2010

Projections: Table A2.

Figure 15. Annual Additions of Electricity Generating Capability, Base Case, 1989-2010

History: *Annual Energy Review 1988*. Projections: Table A7.

Table 3. Comparison of Energy Forecasts, 2010

History: *Short Term Energy Outlook*, DOE/EIA-0202(89/4Q). Projections: American Gas Association, *Total Energy Resource Analysis Model*, The 1989 AGA-TERA Base Case, April 7, 1989; Energy Information Administration, this volume; DRI/McGraw-Hill, *Energy Review*, Autumn 1989; Gas Research Institute, *1989 GRI Baseline Projection of U.S. Energy Supply and Demand*, 1989; The WEFA Group, *Energy Analysis Quarterly*, Summer 1989, and *Long-Term Economic Outlook*, Third Quarter 1989.

Figure 16. Assumed Growth Rates for GNP, Oil Price, Inflation, Personal Income, and Manufacturing Production, 1988-2010

See sources for Table 3.

Figure 17. Annual Growth Rates for Total Energy Demand, Electricity Demand, and Total Energy Intensity, 1988-2010

See sources for Table 3.

Figure 18. Change in Consumption of Major Energy Sources, 1988-2010

See sources for Table 3.